August 03 - Tuning Results and Recommendations

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Procedures

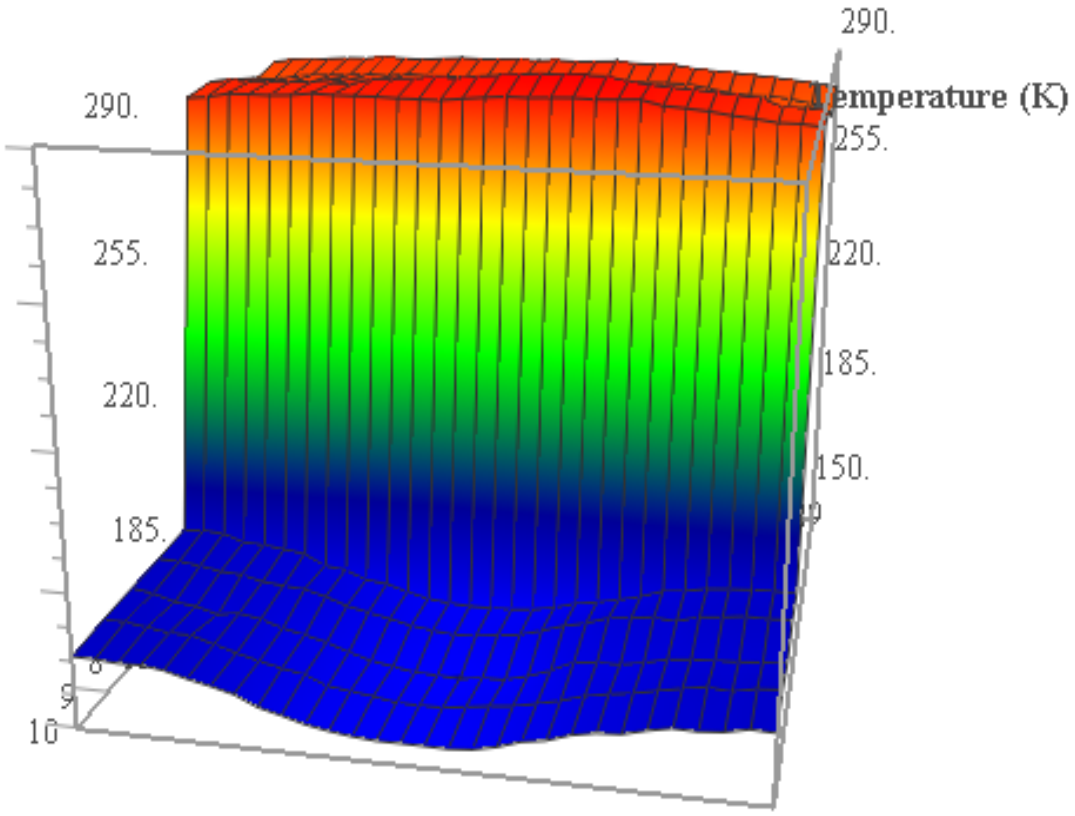
- The following slides are based on a selection of regions screened for minimal cloud effects
  - Screened for small local variance
  - Smallest spot sample is collected
  - For each spot in the smallest sample, the closest match is found in the remaining samples based on the EMC profiles
  - Result is all spots with the same sample size and similar profiles
- Measured values are compared to ECMWF with the upper atmosphere blended with a regression retrieval based on AIRS data
- These data have the JPL angle adjustment applied

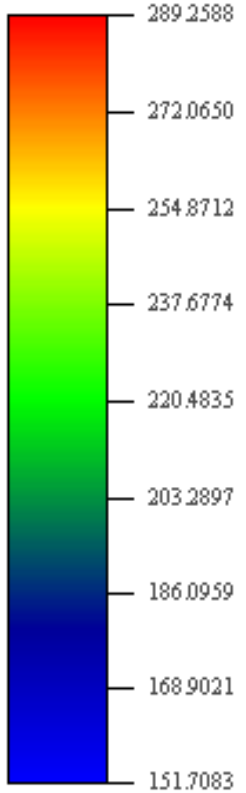
Slide Description

- The next 15 slides show the average measured temperatures for each channel as a function of the case
- The first five cases are the focus days over land (Sept. 9-02, Sept. 29-02 Nov. 11-02, March 1-03, March 20-03, and April 9-03).
- The next five cases are the same days over sea.

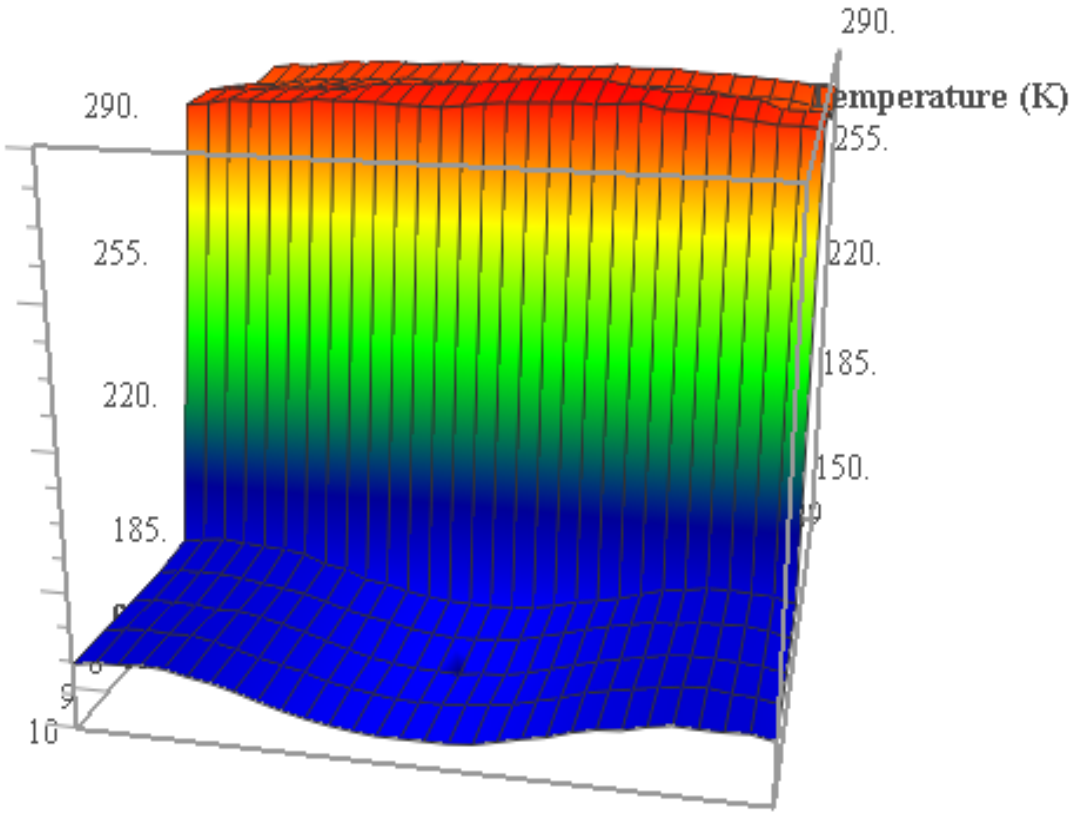
- These cases are available as agl files which can be viewed using a free software package available from the following address
- http://h18009.www1.hp.com/fortran/aview/getviewer.html

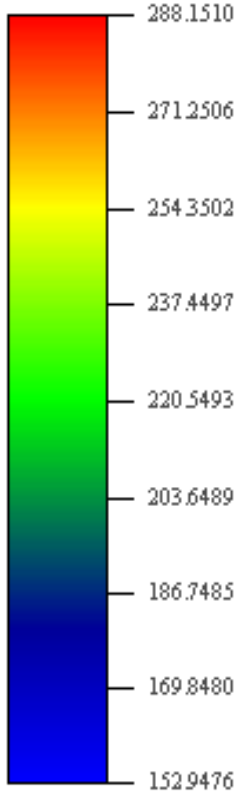
Channel 1 spot 1 on the left



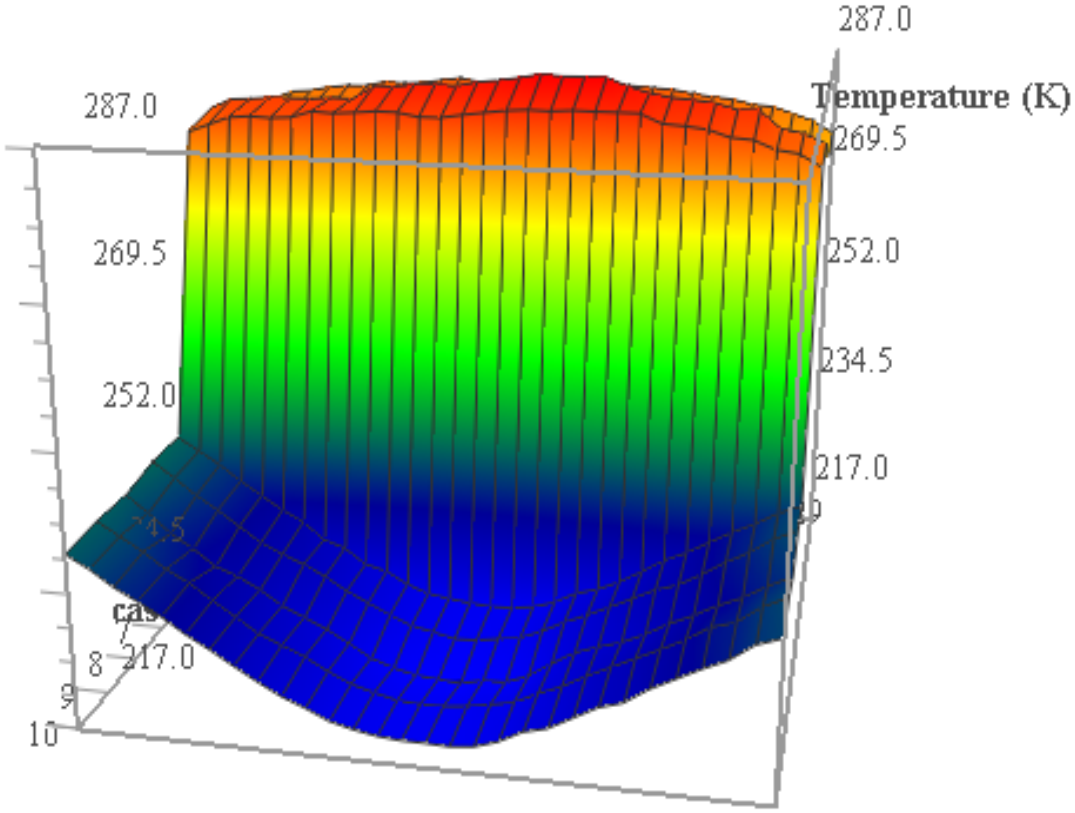


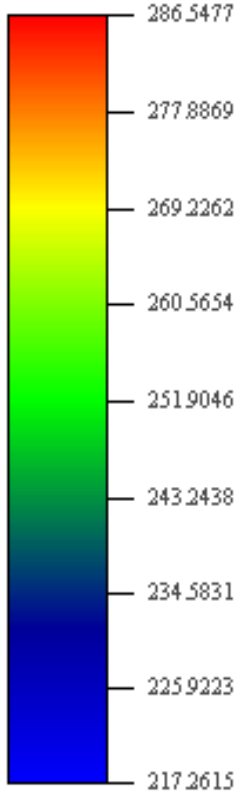
Channel 2 spot 1 on the left



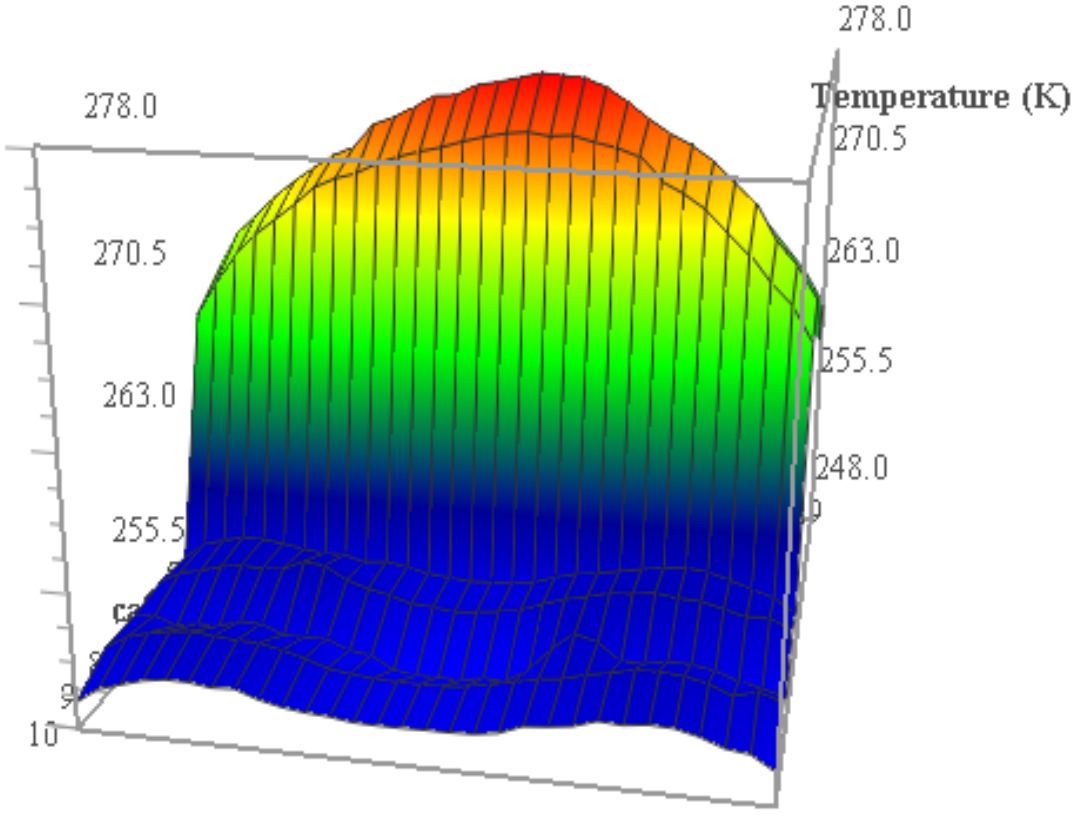


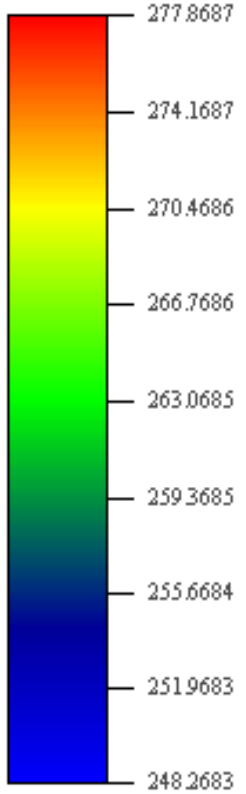
Channel 3 spot 1 on the left



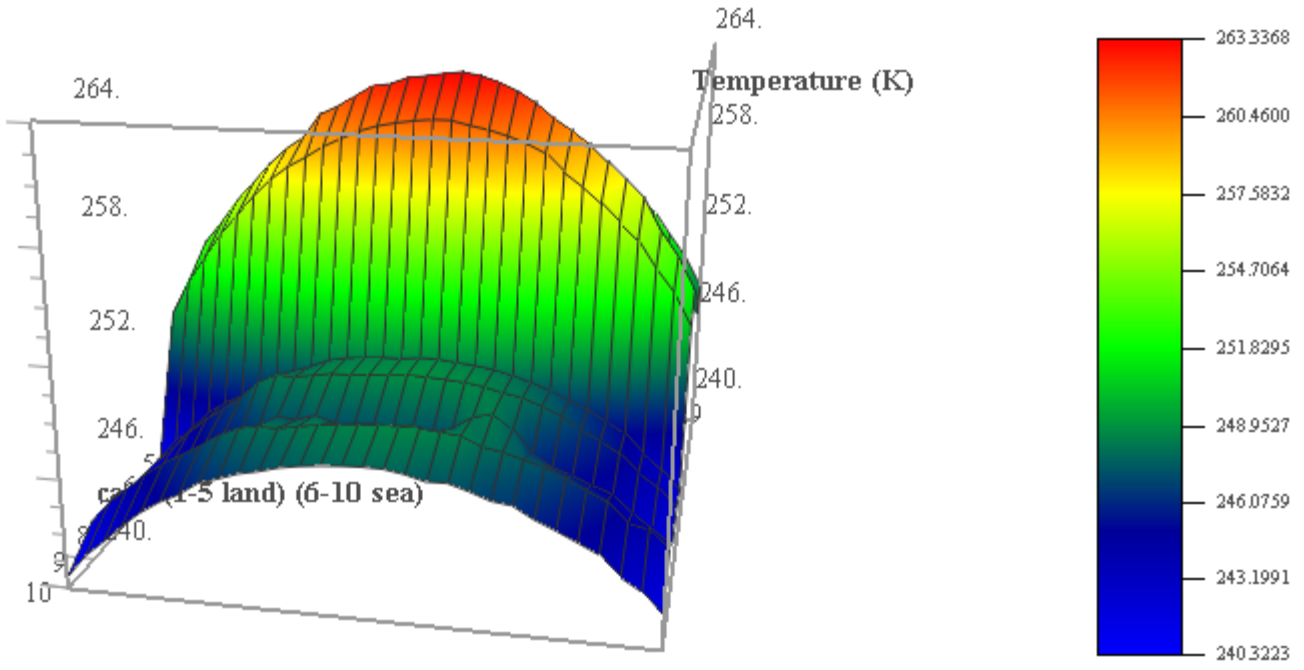


Channel 4 spot 1 on the left

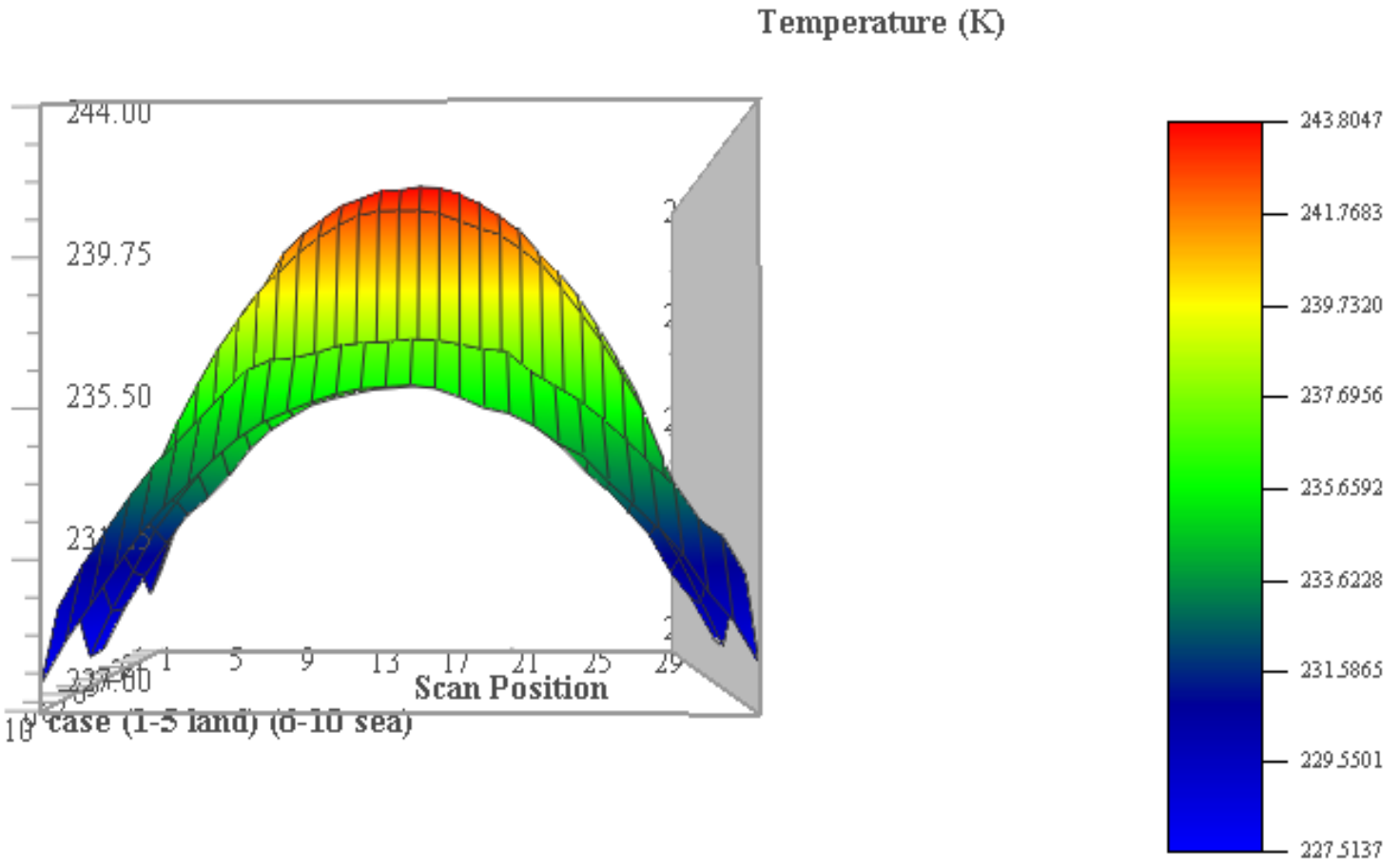




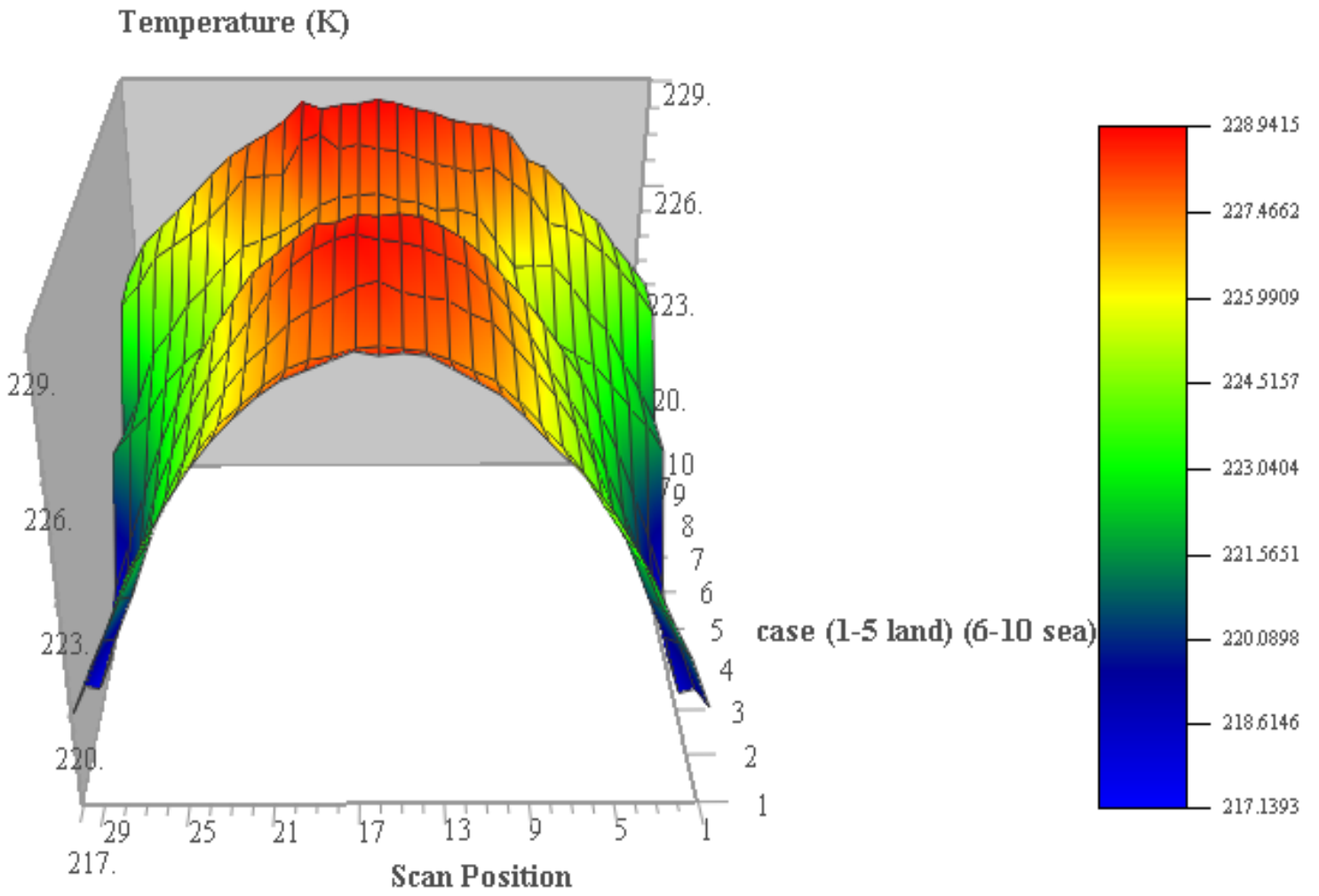
Channel 5 spot 1 on the left



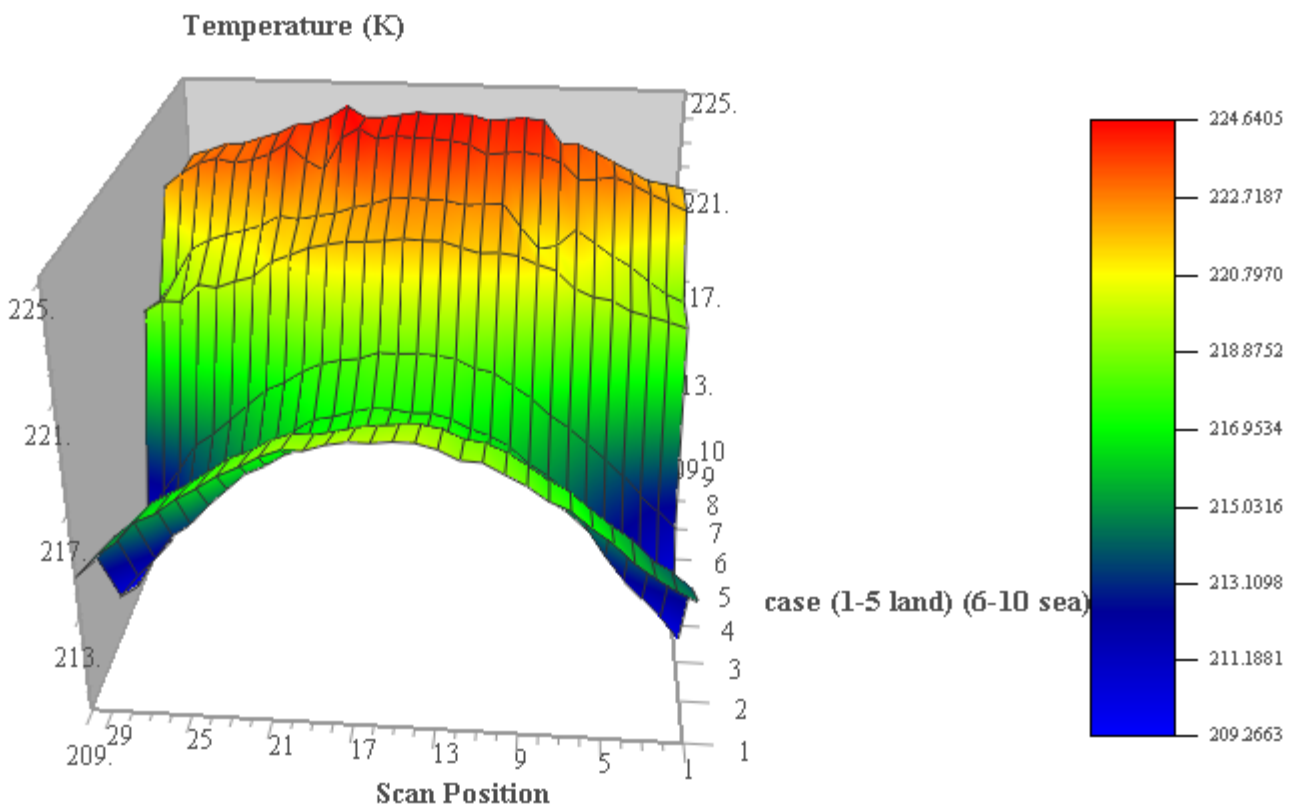
Channel 6 spot 1 on the left



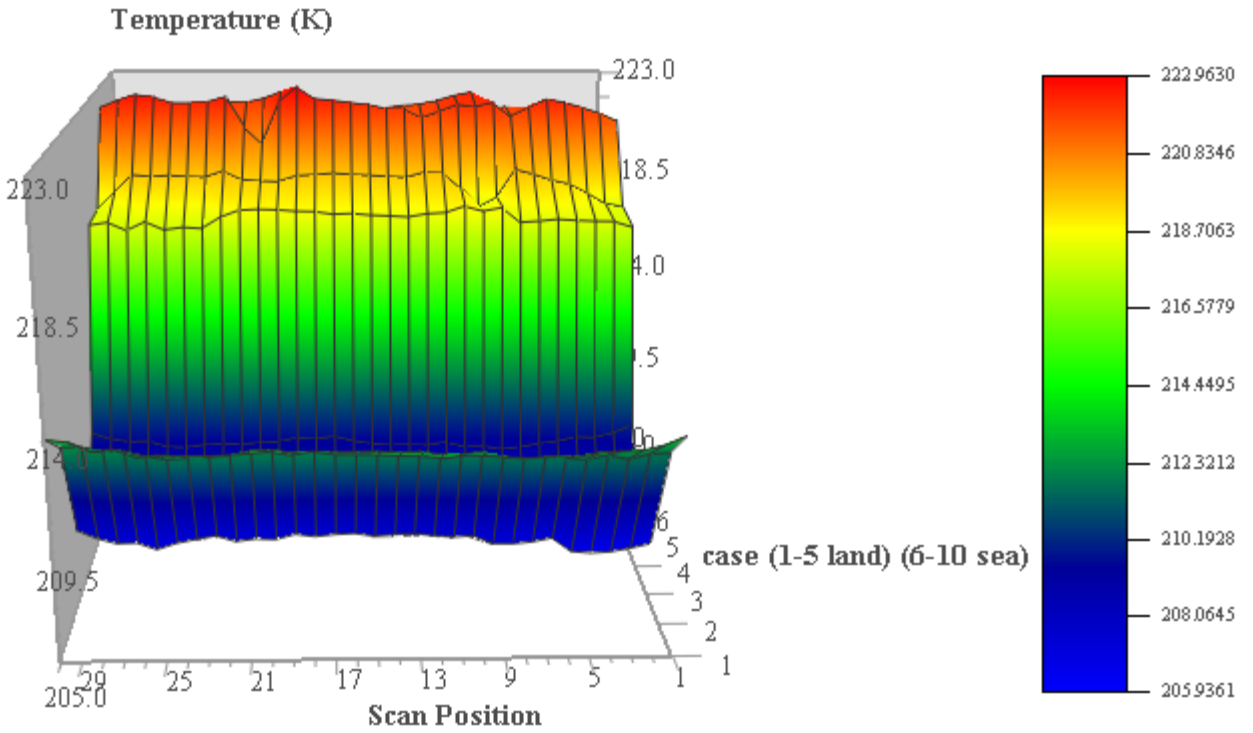
Channel 7 spot 1 on the right



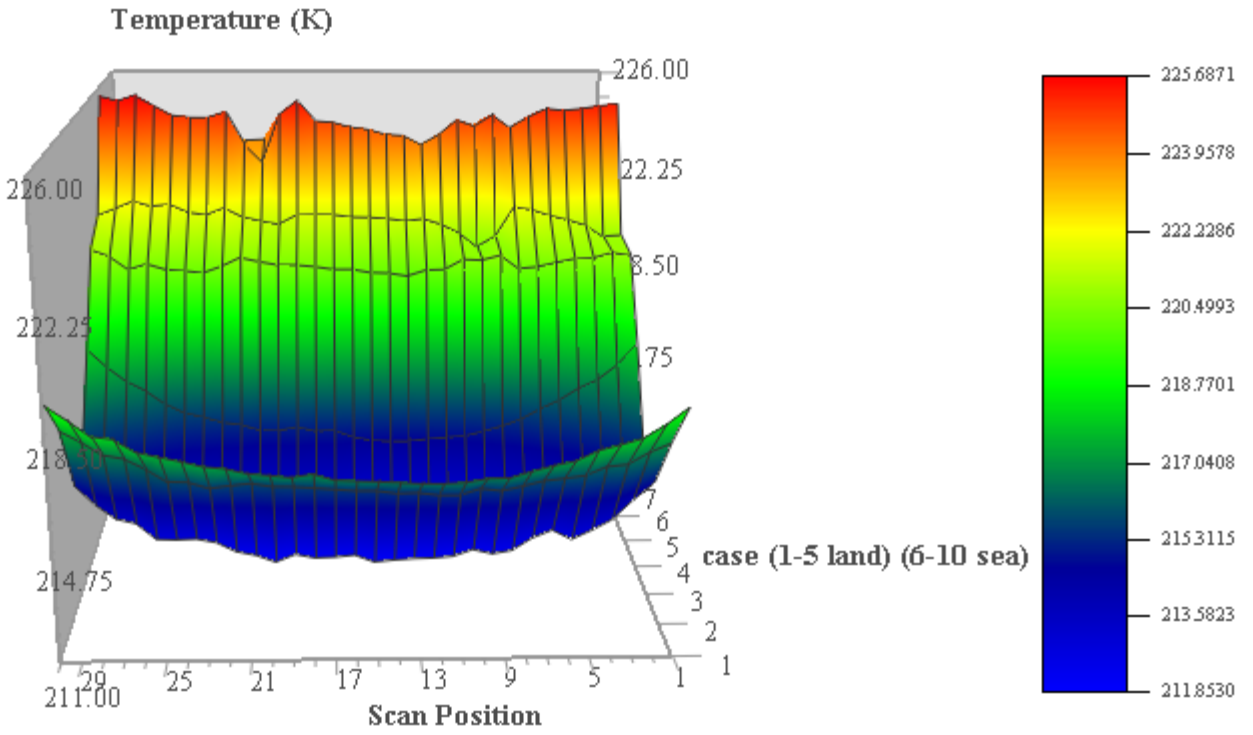
Channel 8 spot 1 on the right



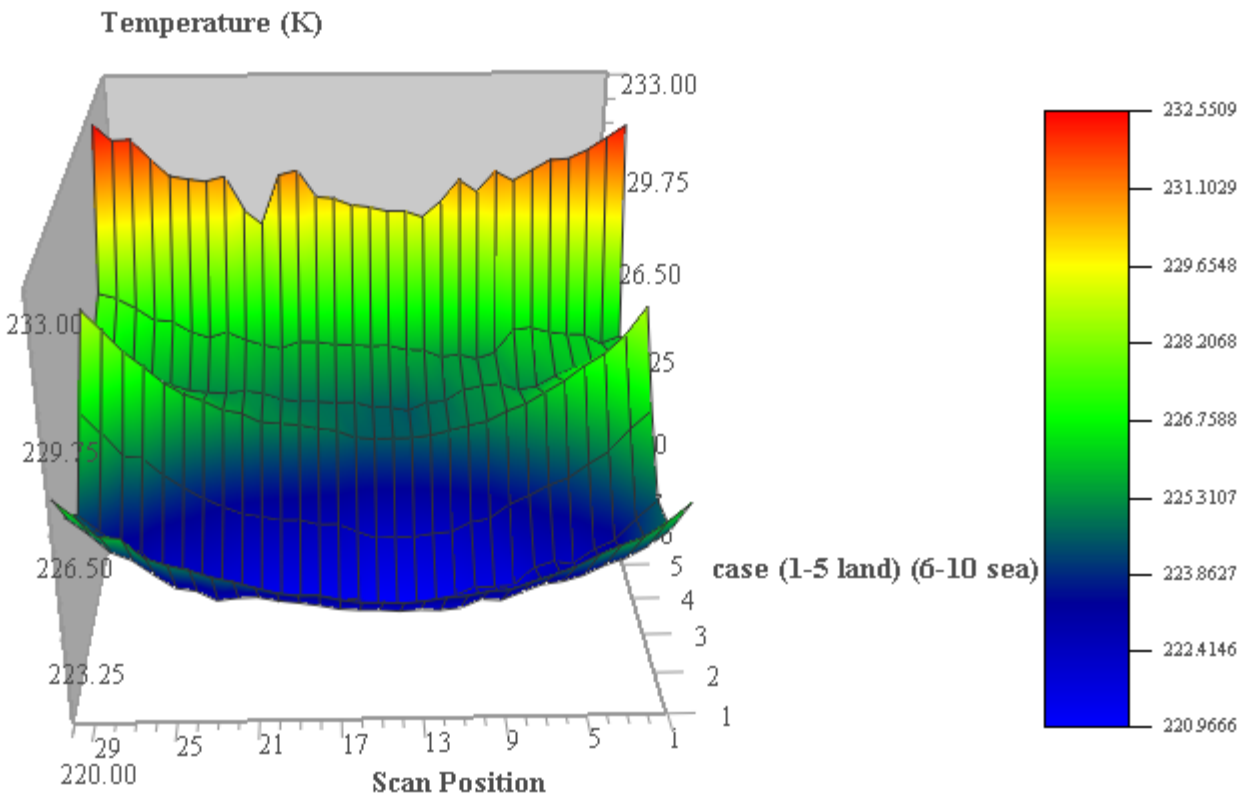
Channel 9 spot 1 on the right



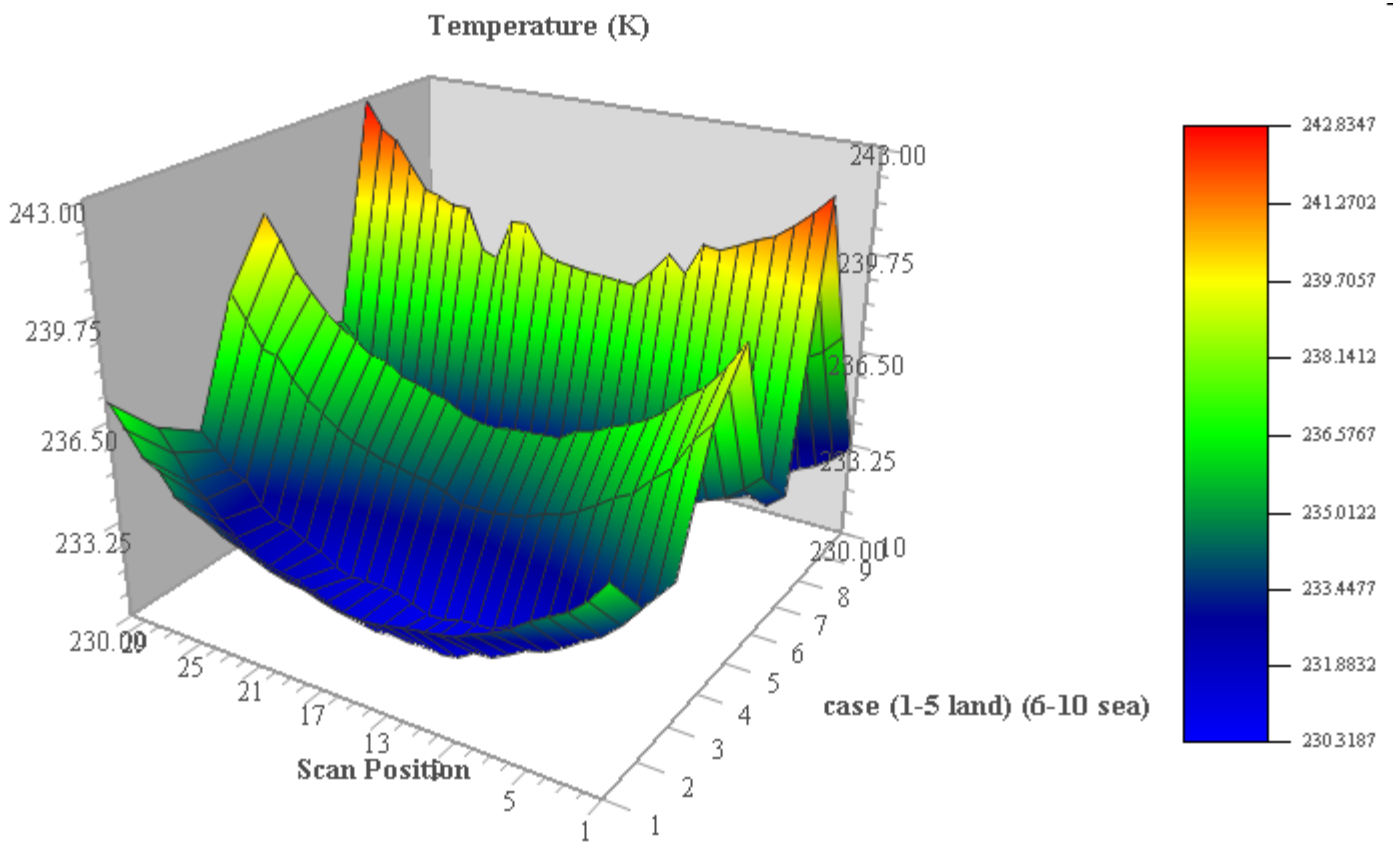
Channel 10 spot 1 on the right



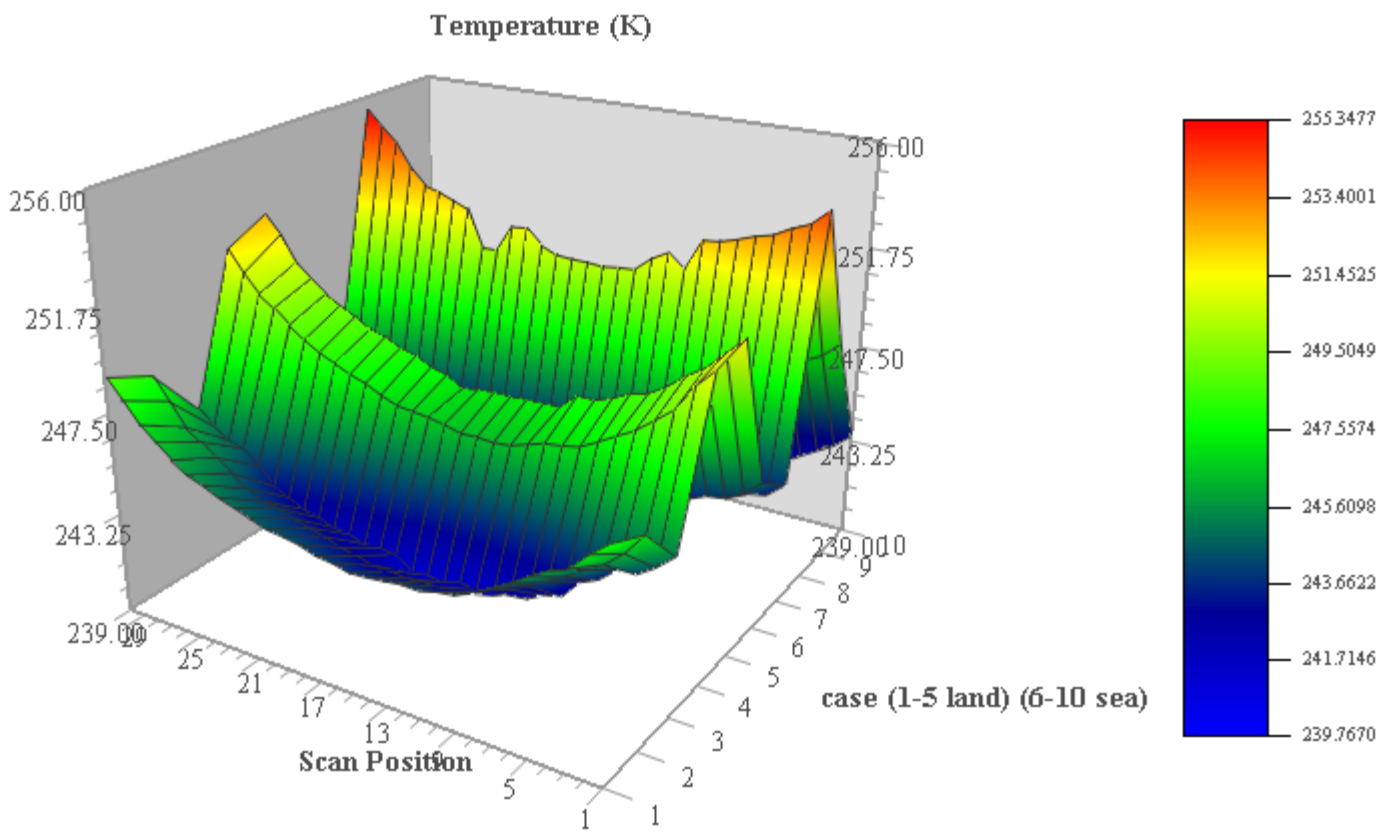
Channel 11 spot 1 on the right



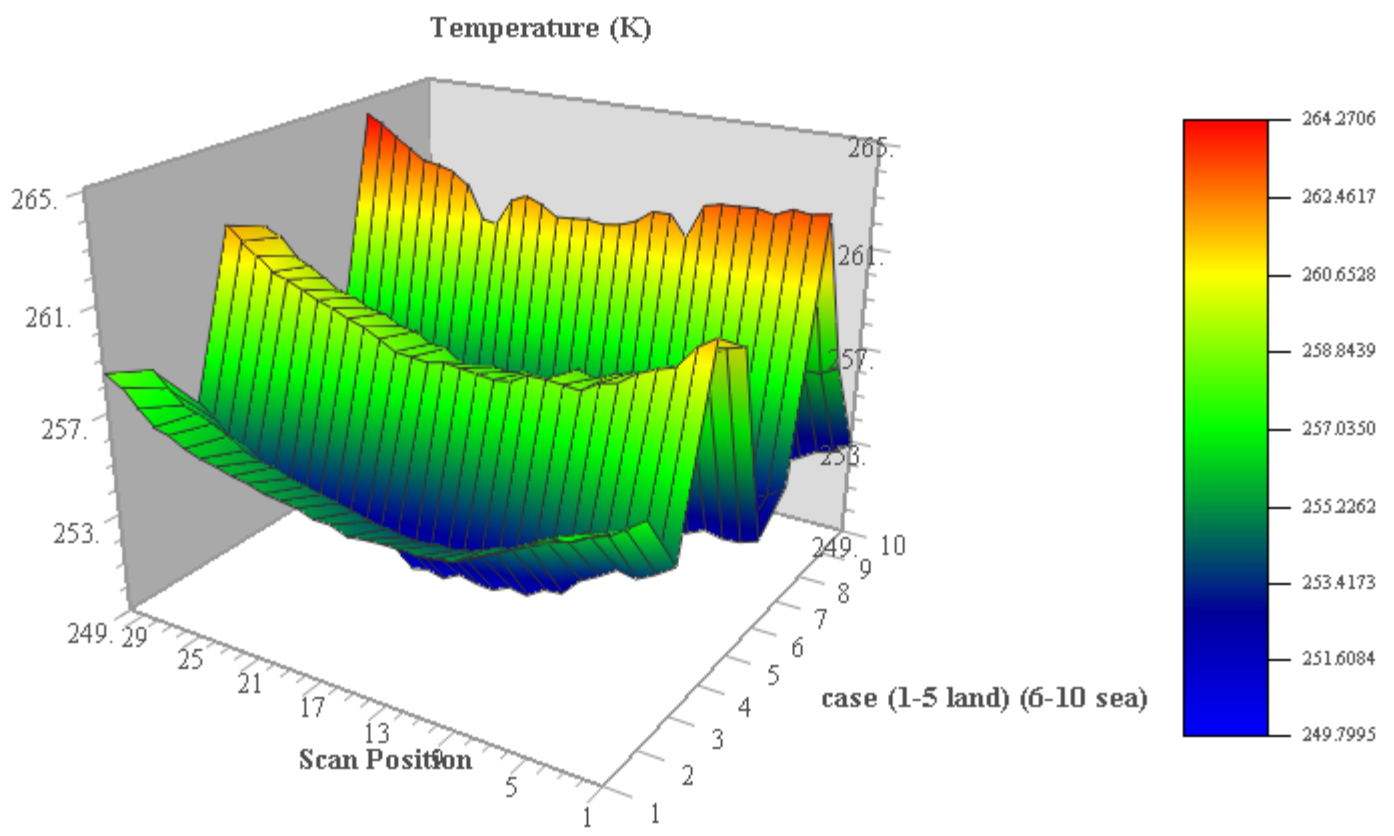
Channel 12 spot 1 on the right



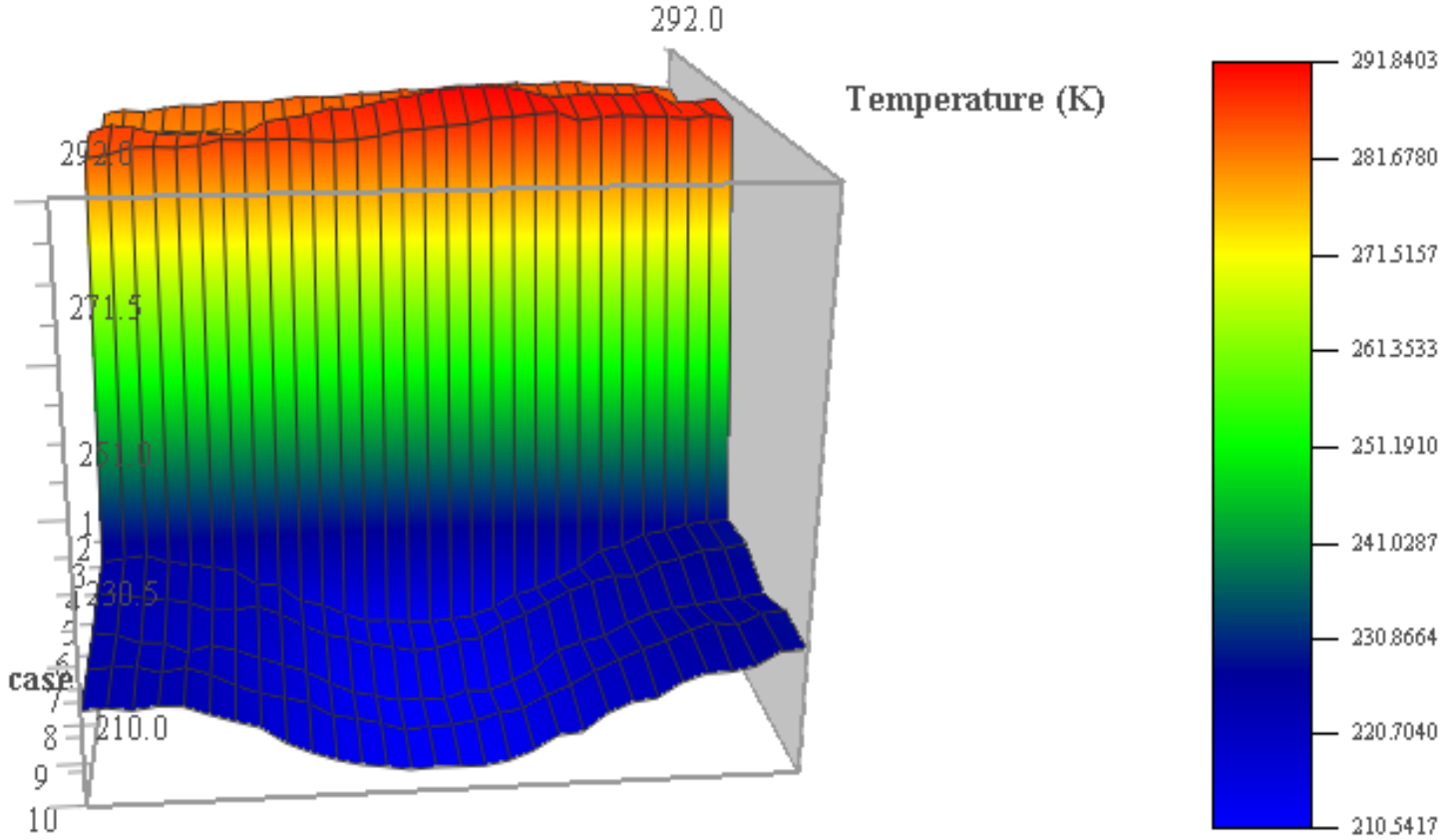
Channel 13 spot 1 on the right



Channel 14 spot 1 on the right



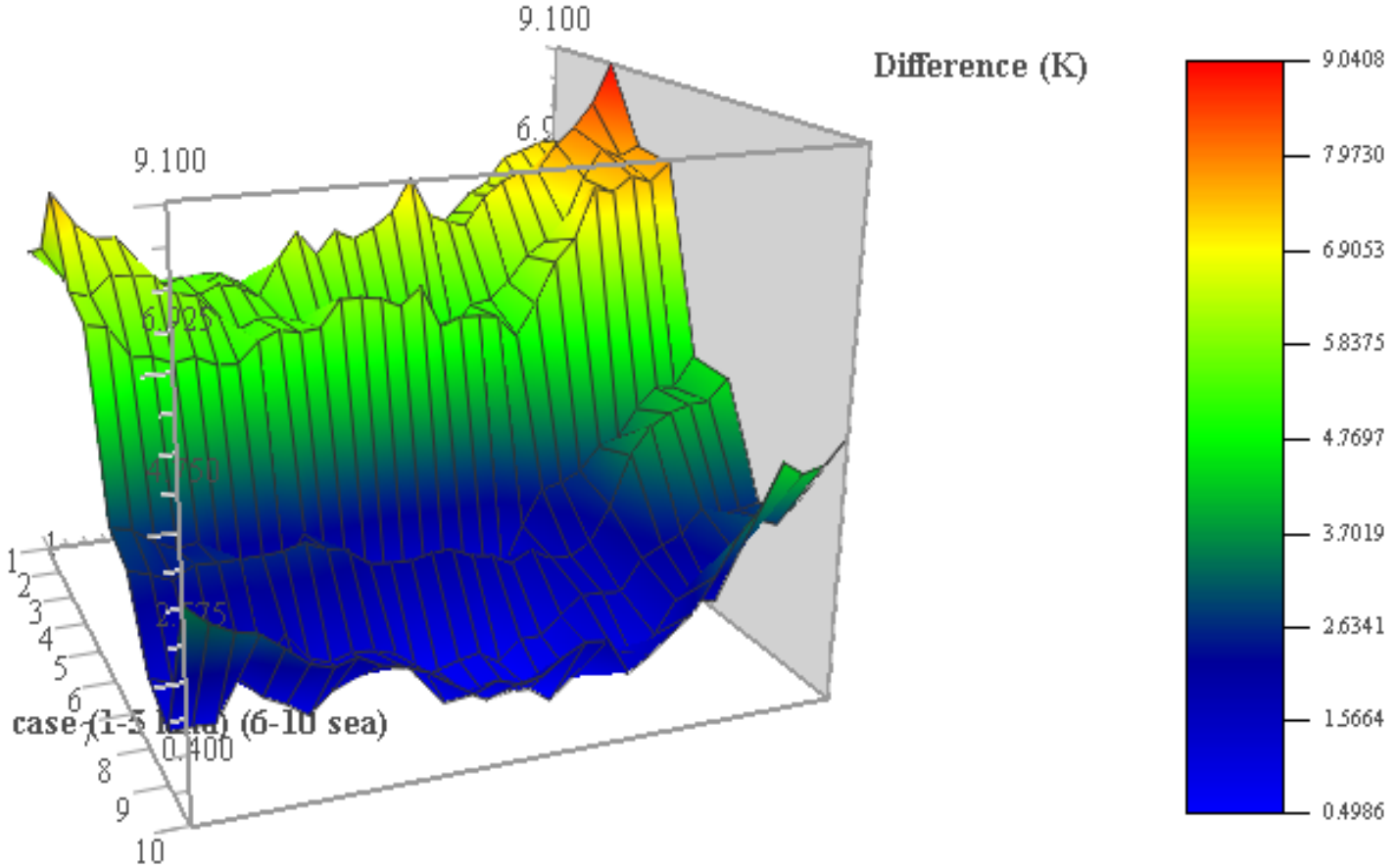
Channel 15 spot 1 on the left



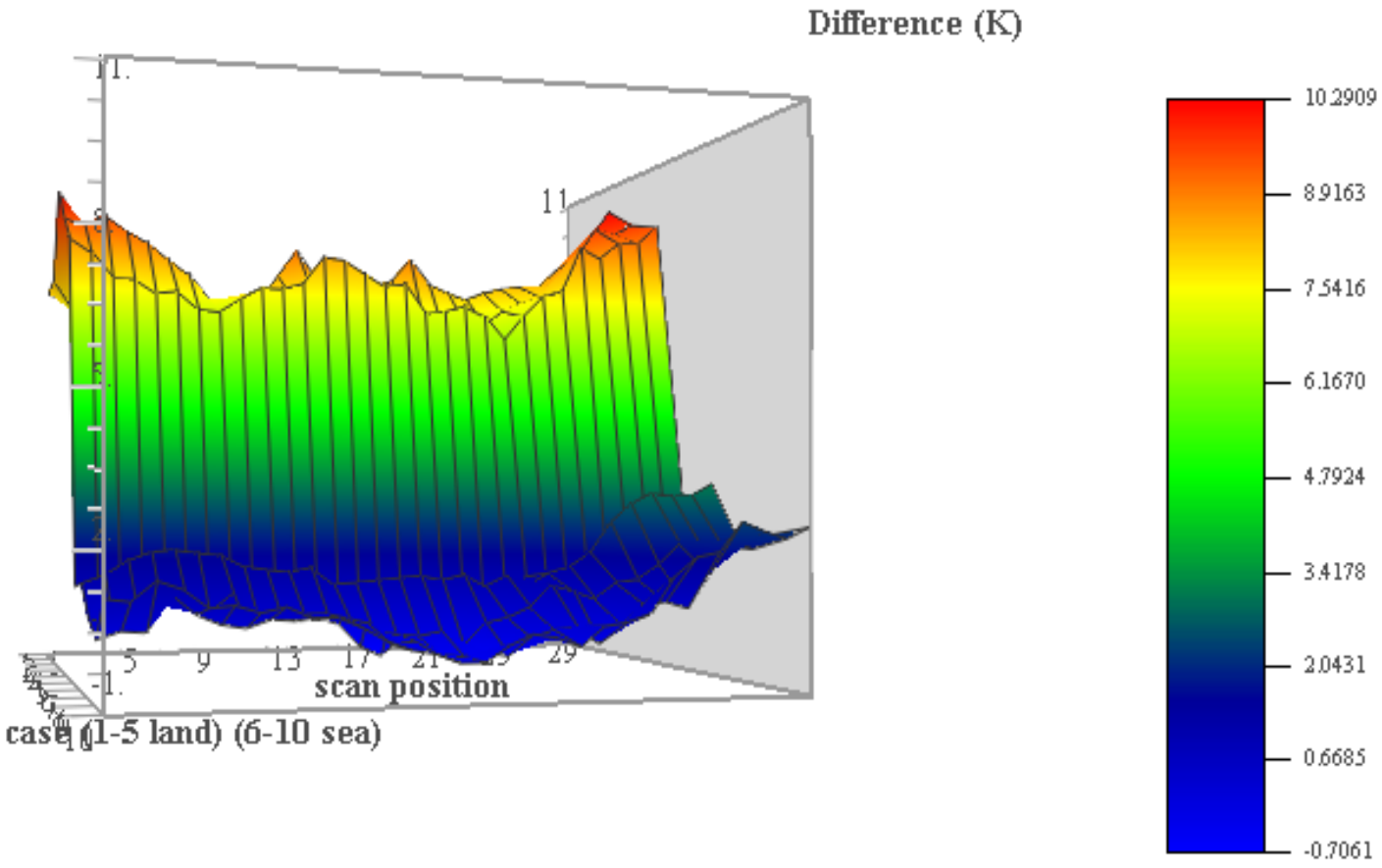
Slide Description

- The next 15 slides show the measured minus calculated differences for each channel as a function of the case
- The first five cases are the focus days over land (Sept. 9-02, Sept. 29-02 Nov. 11-02, March 1-03, March 20-03, and April 9-03).
- The next five cases are the same days over sea.

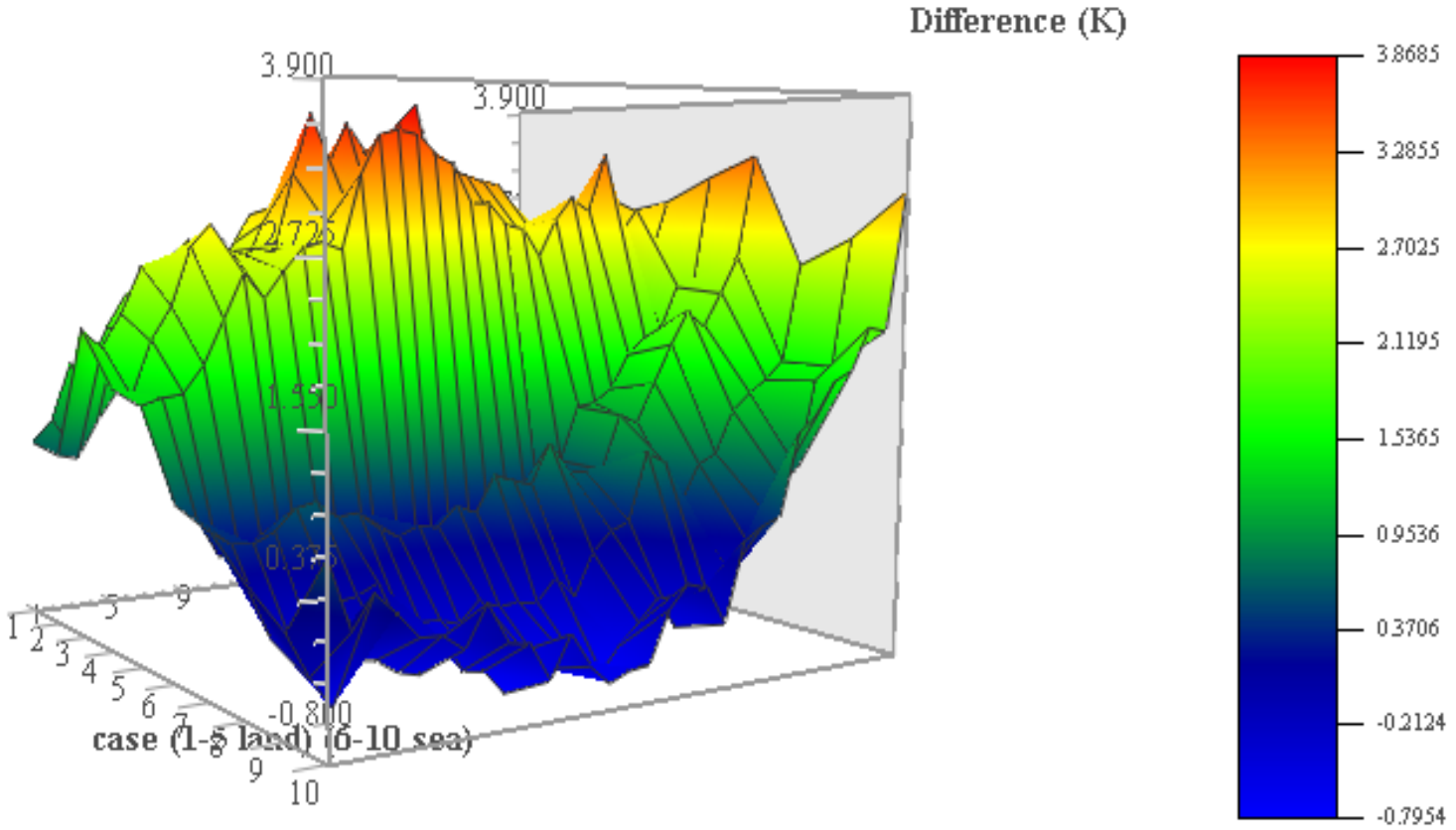
Channel 1 (measured – calculated difference) spot 1 on the left



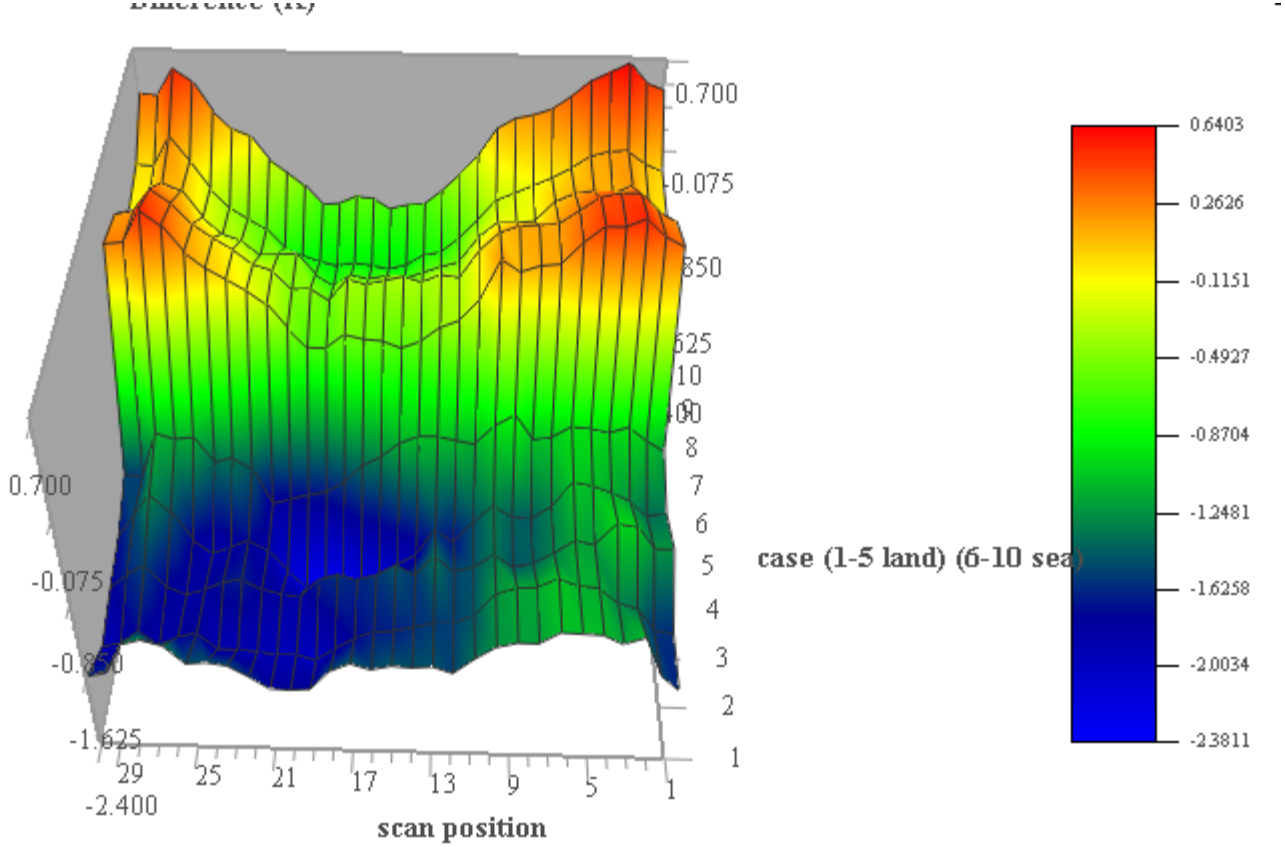
Channel 2 (measured – calculated difference) spot 1 on the left



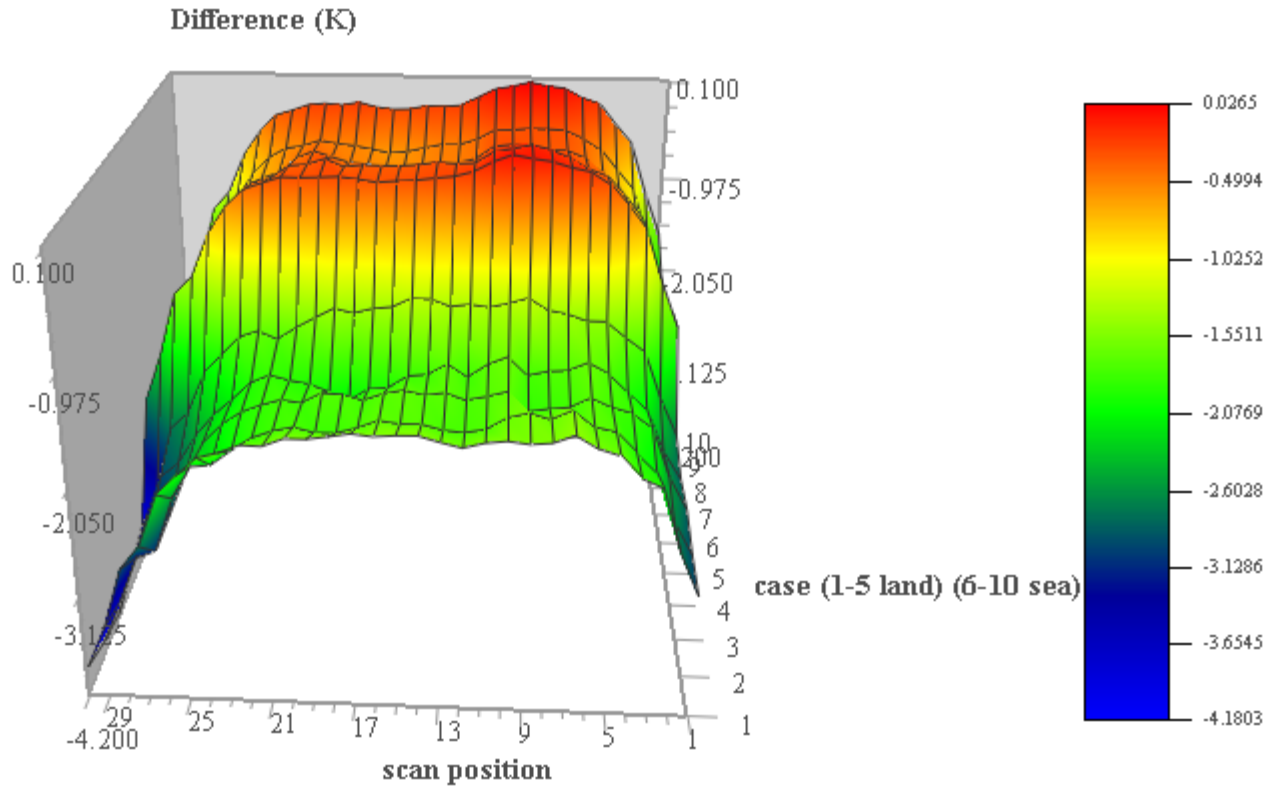
Channel 3 (measured – calculated difference) spot 1 on the left



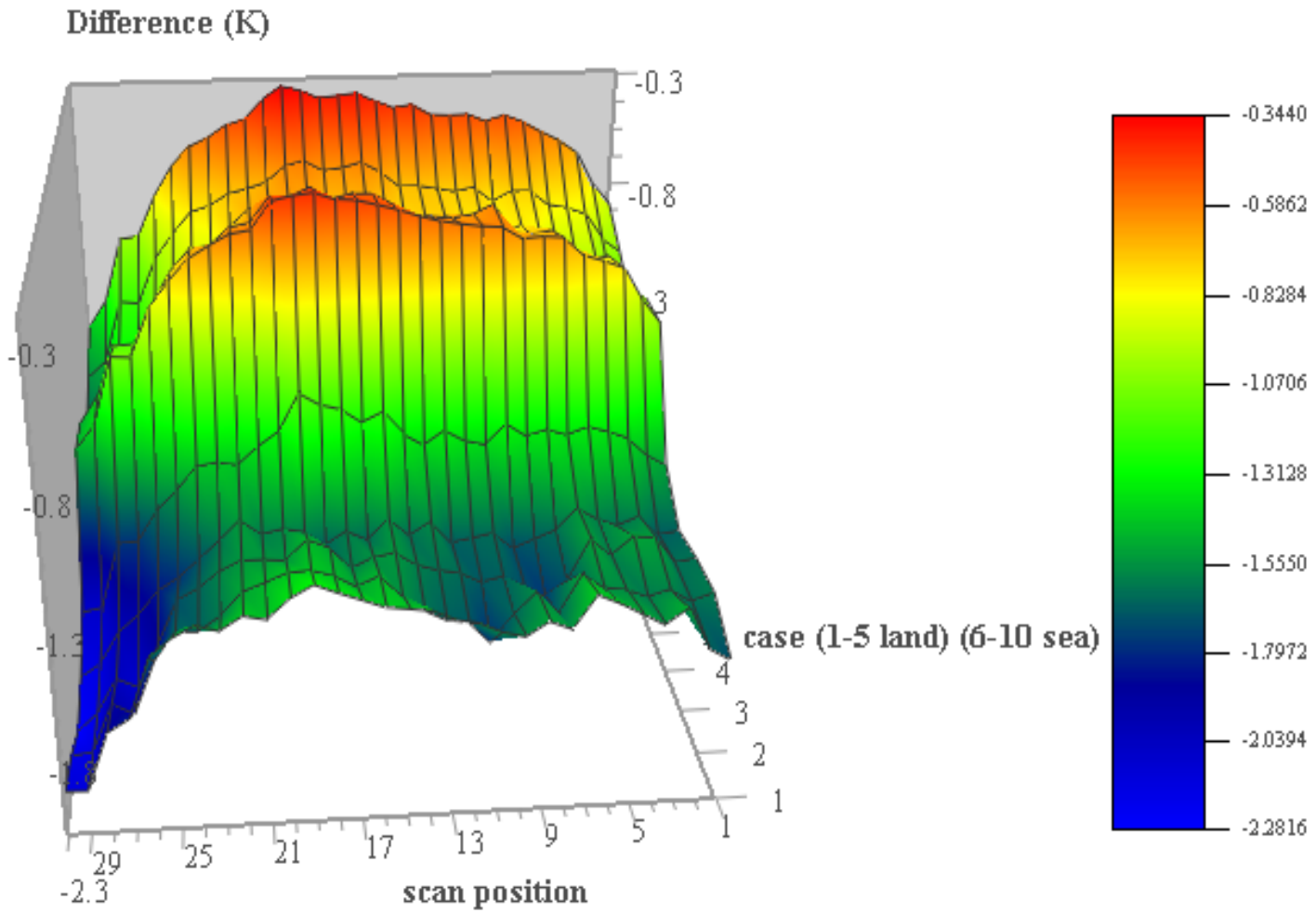
Channel 4 (measured – calculated difference) spot 1 on the right



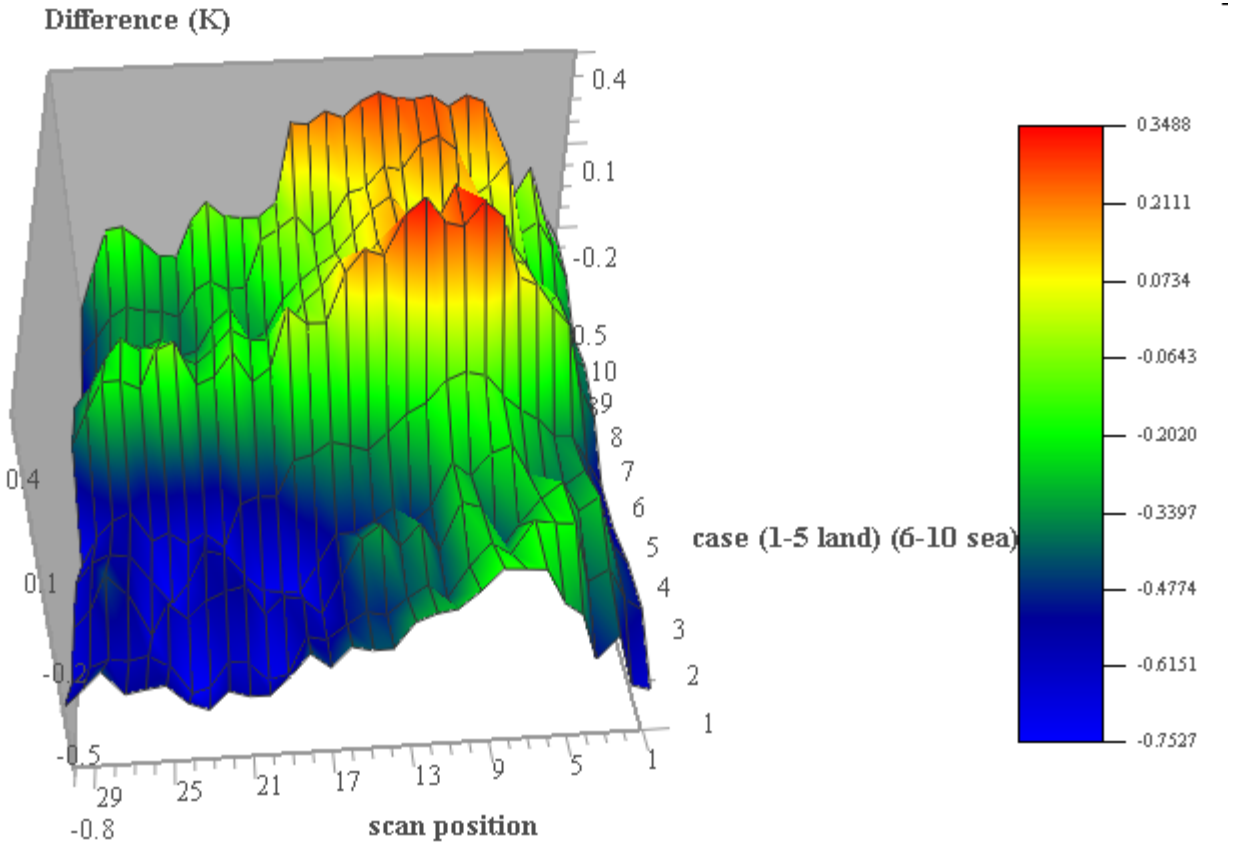
Channel 5 (measured – calculated difference) spot 1 on the right



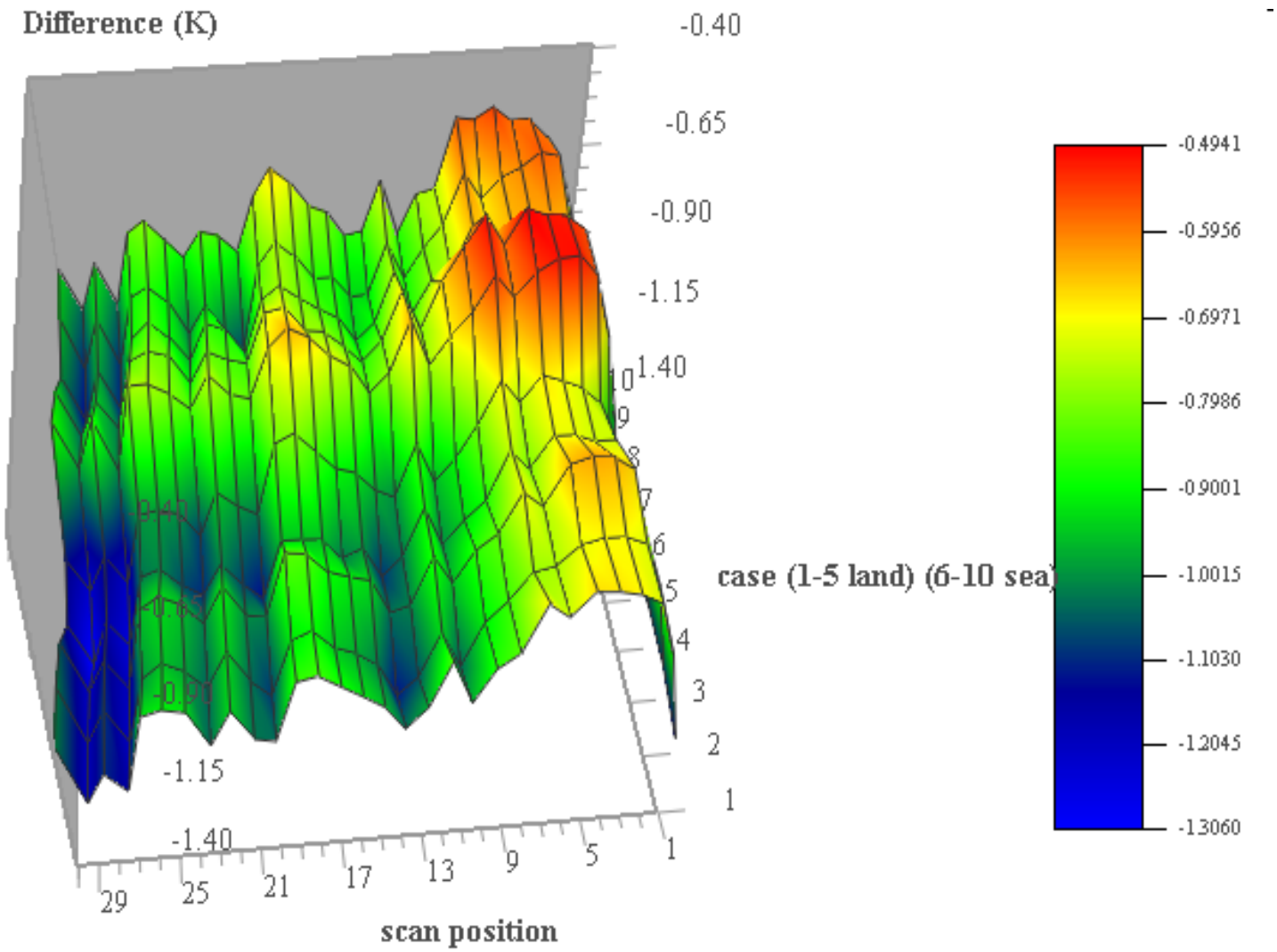
Channel 6 (measured – calculated difference) spot 1 on the right



Channel 7 (measured – calculated difference) spot 1 on the right



Channel 8 (measured – calculated difference) spot 1 on the right



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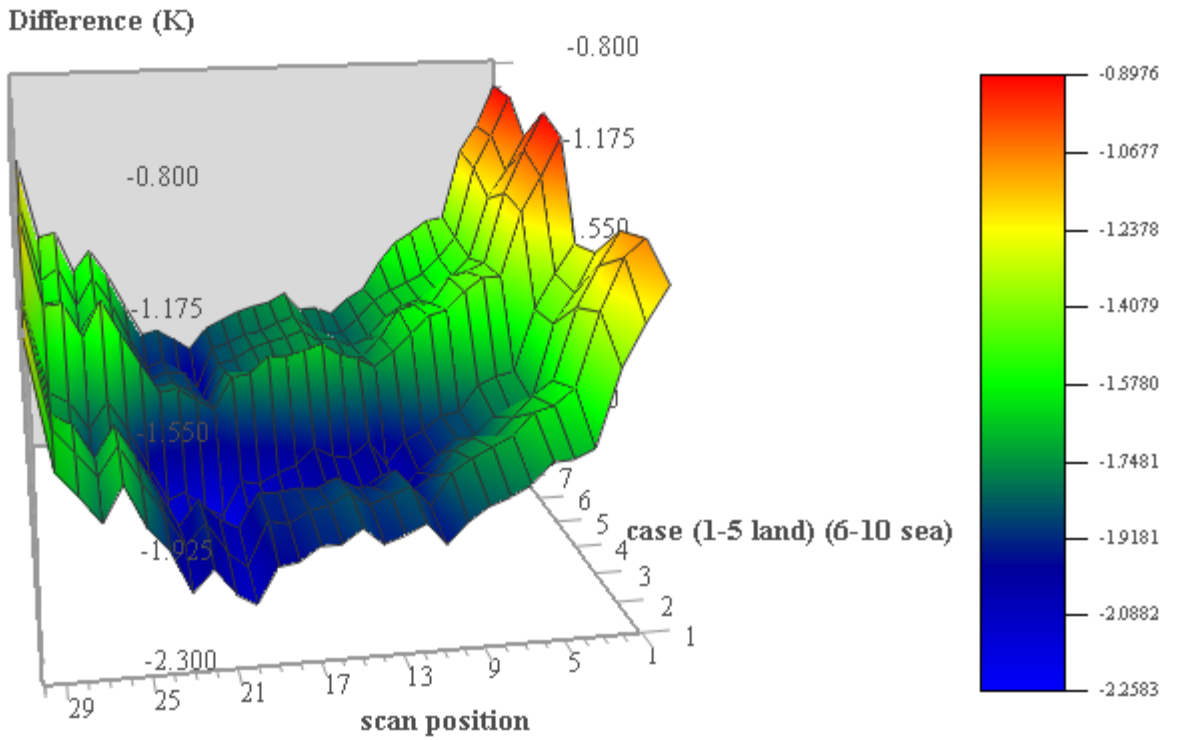
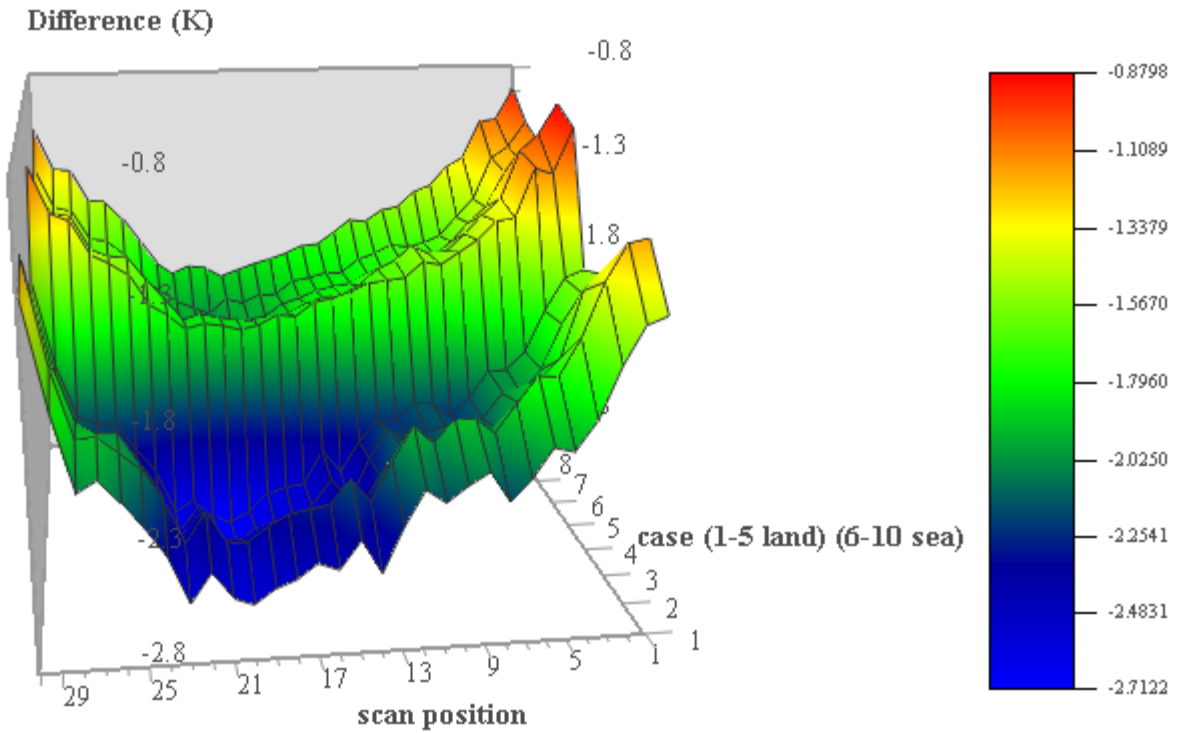
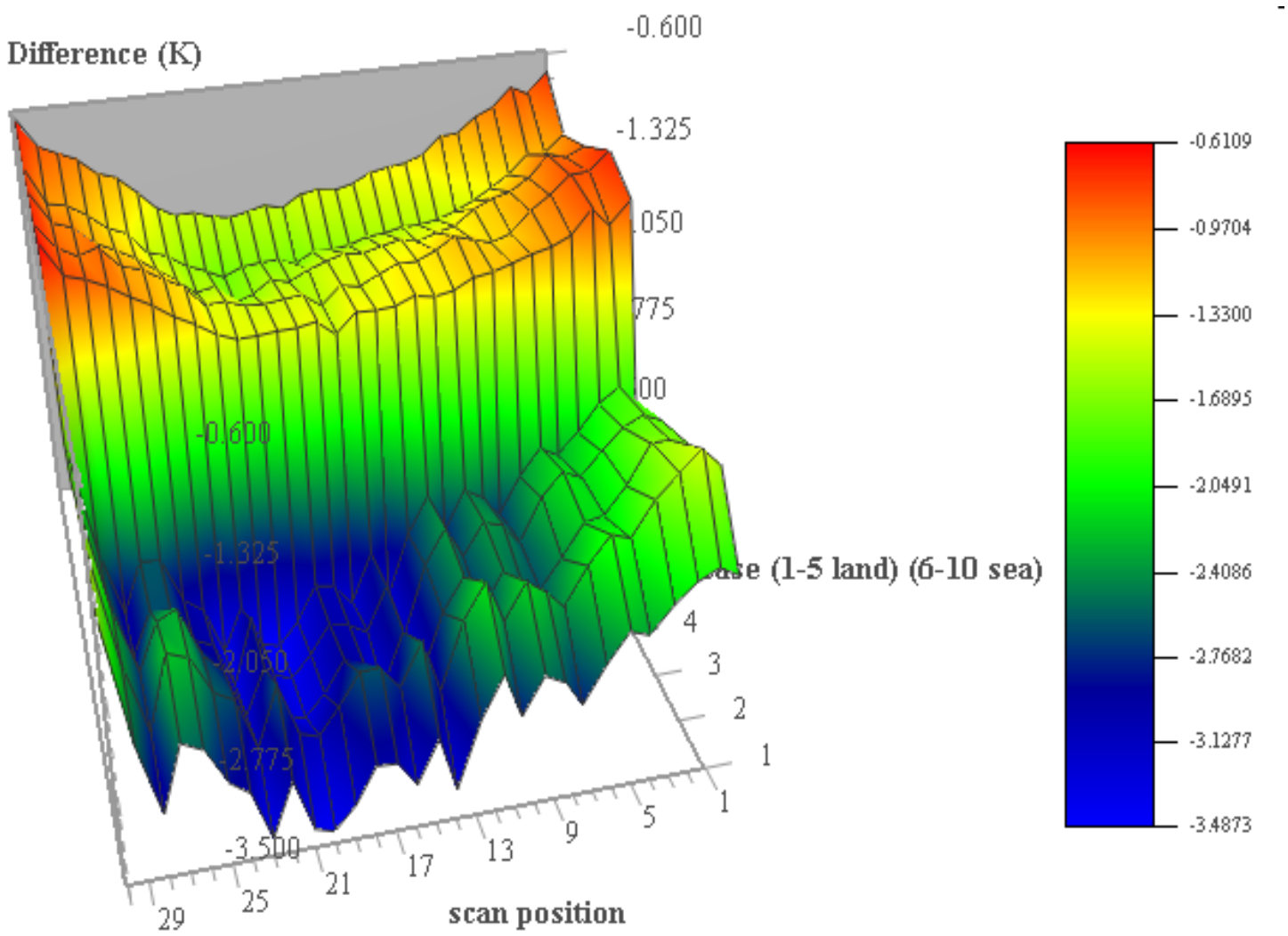
Channel 9 (measured – calculated difference) spot 1 on the right



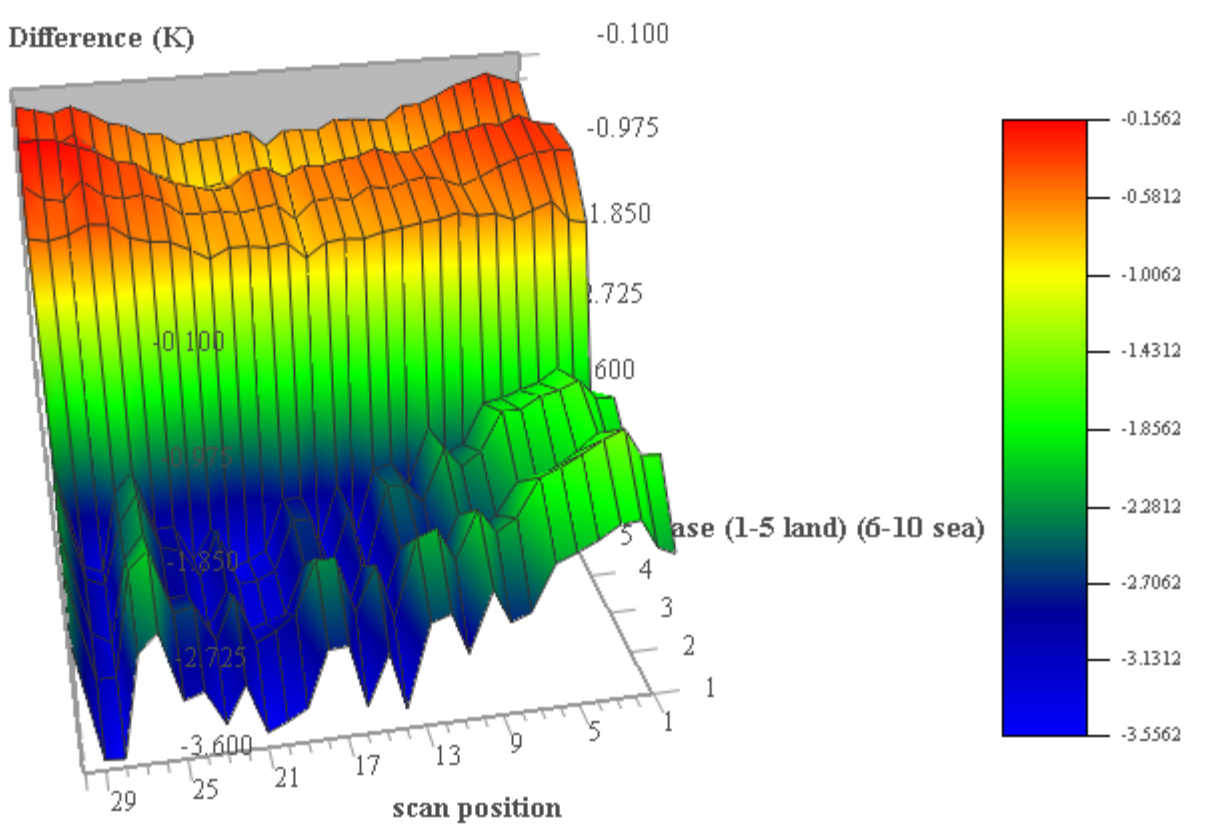
Channel 10 (measured – calculated difference) spot 1 on the right



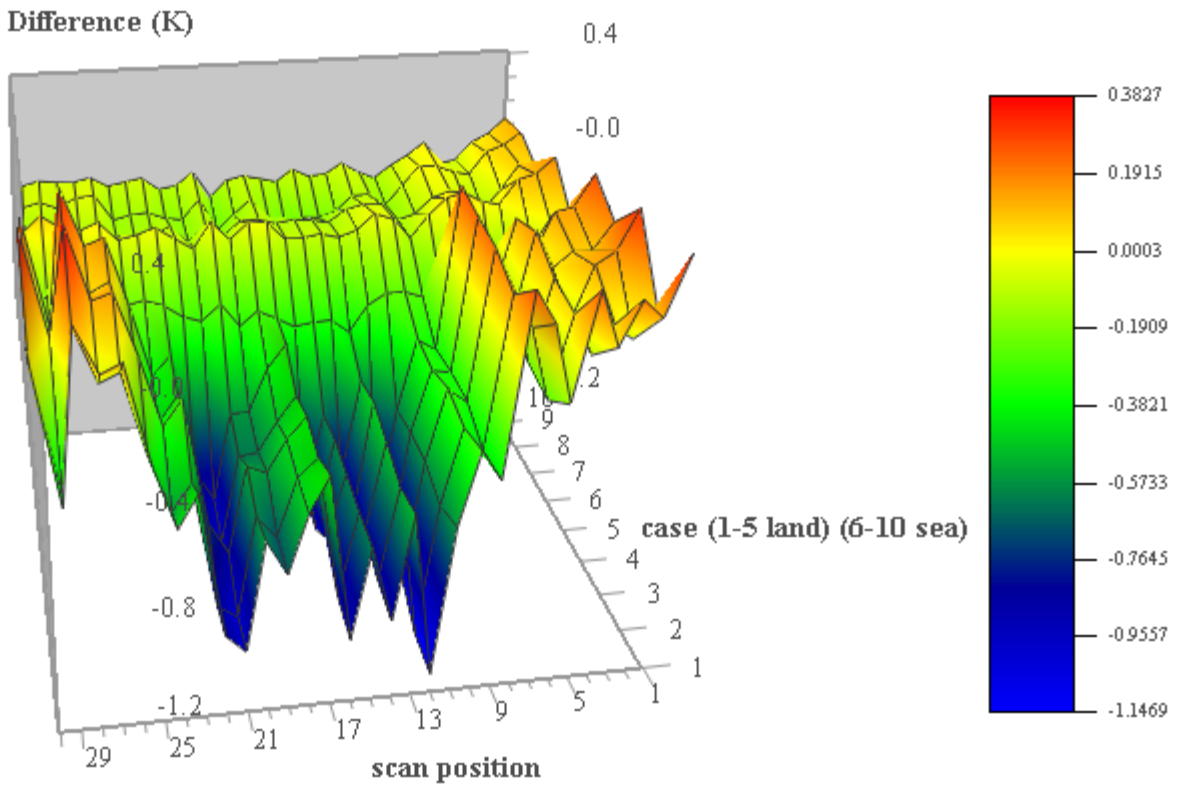
Channel 11 (measured – calculated difference) spot 1 on the right



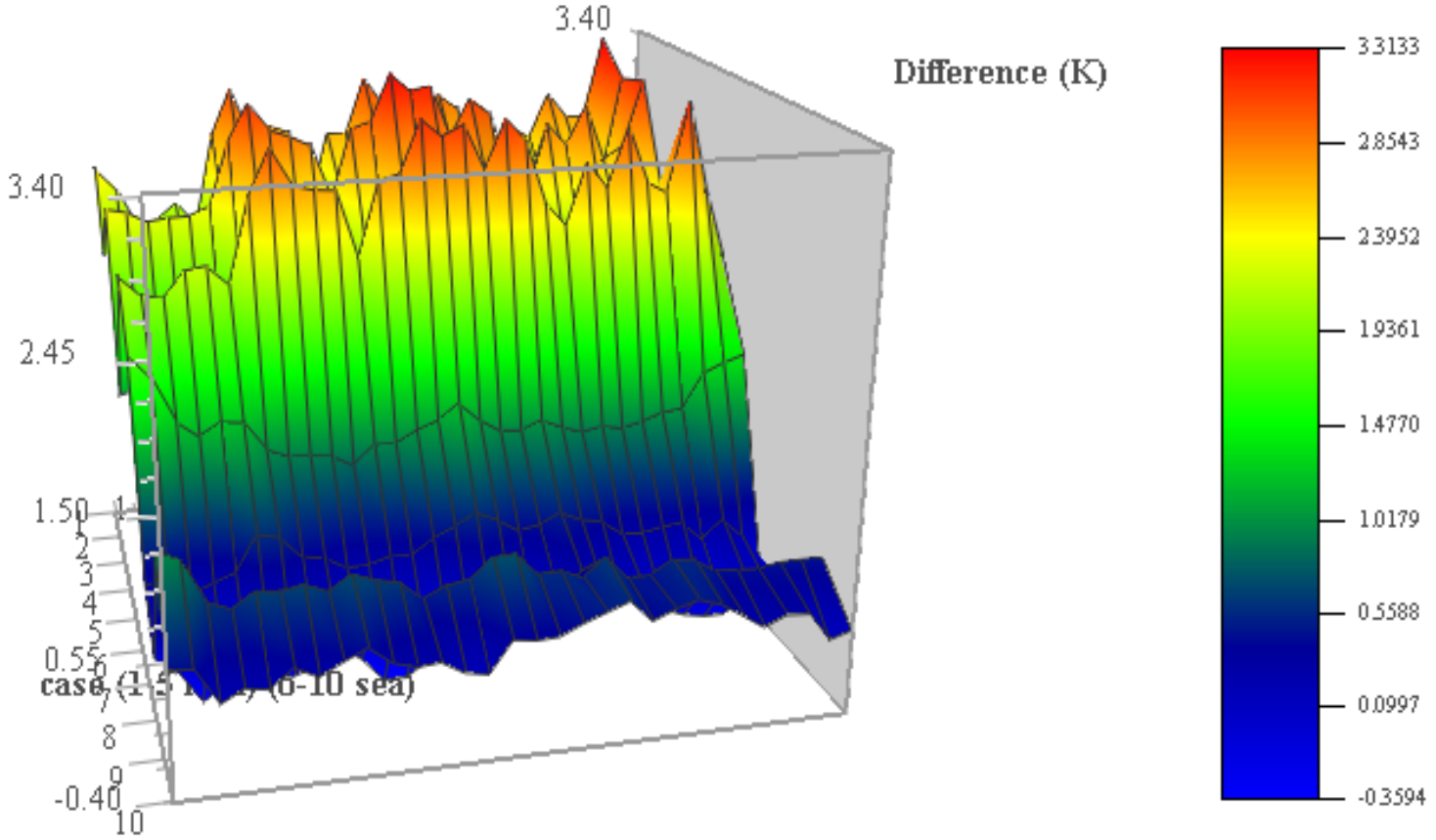
Channel 12 (measured – calculated difference) spot 1 on the right



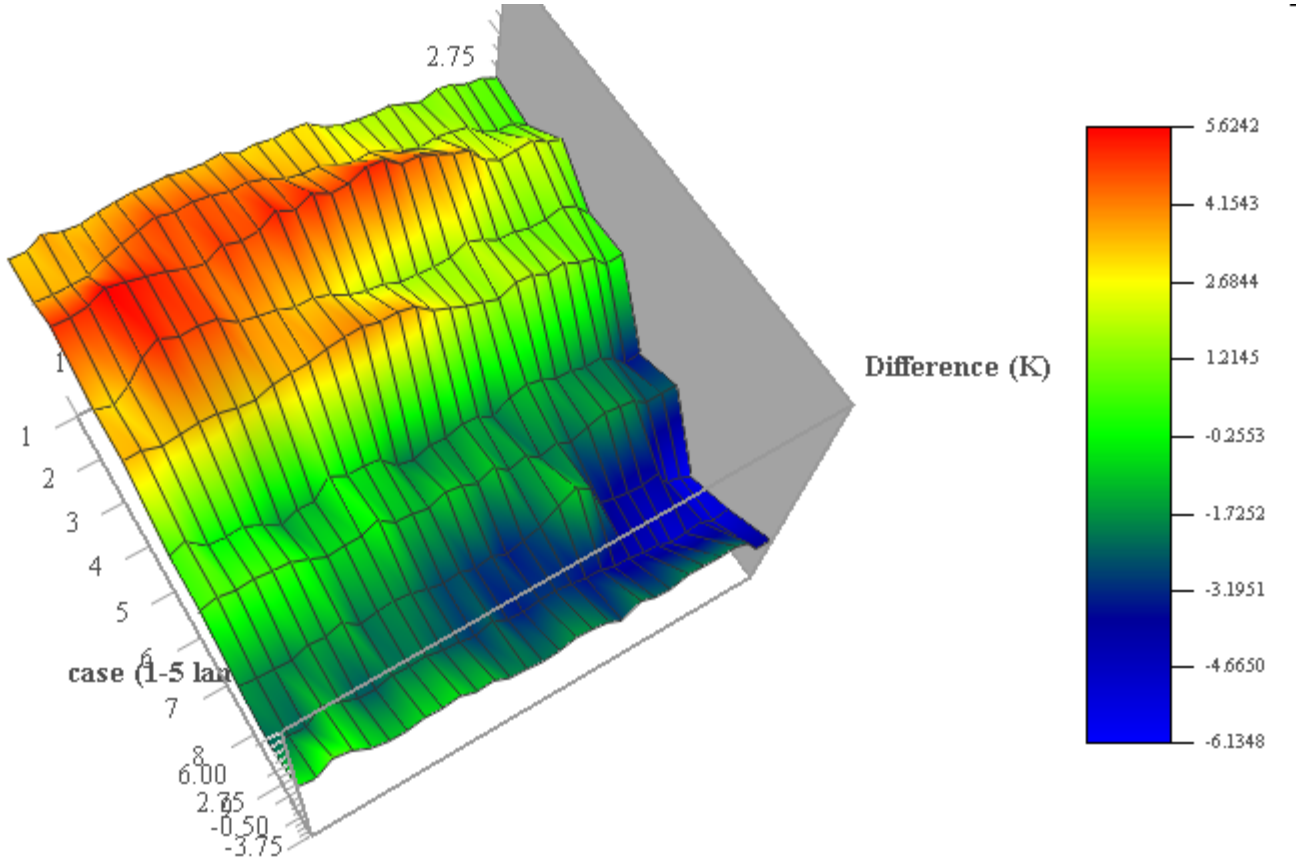
Channel 13 (measured – calculated difference) spot 1 on the right



Channel 14 (measured – calculated difference) spot 1 on the left



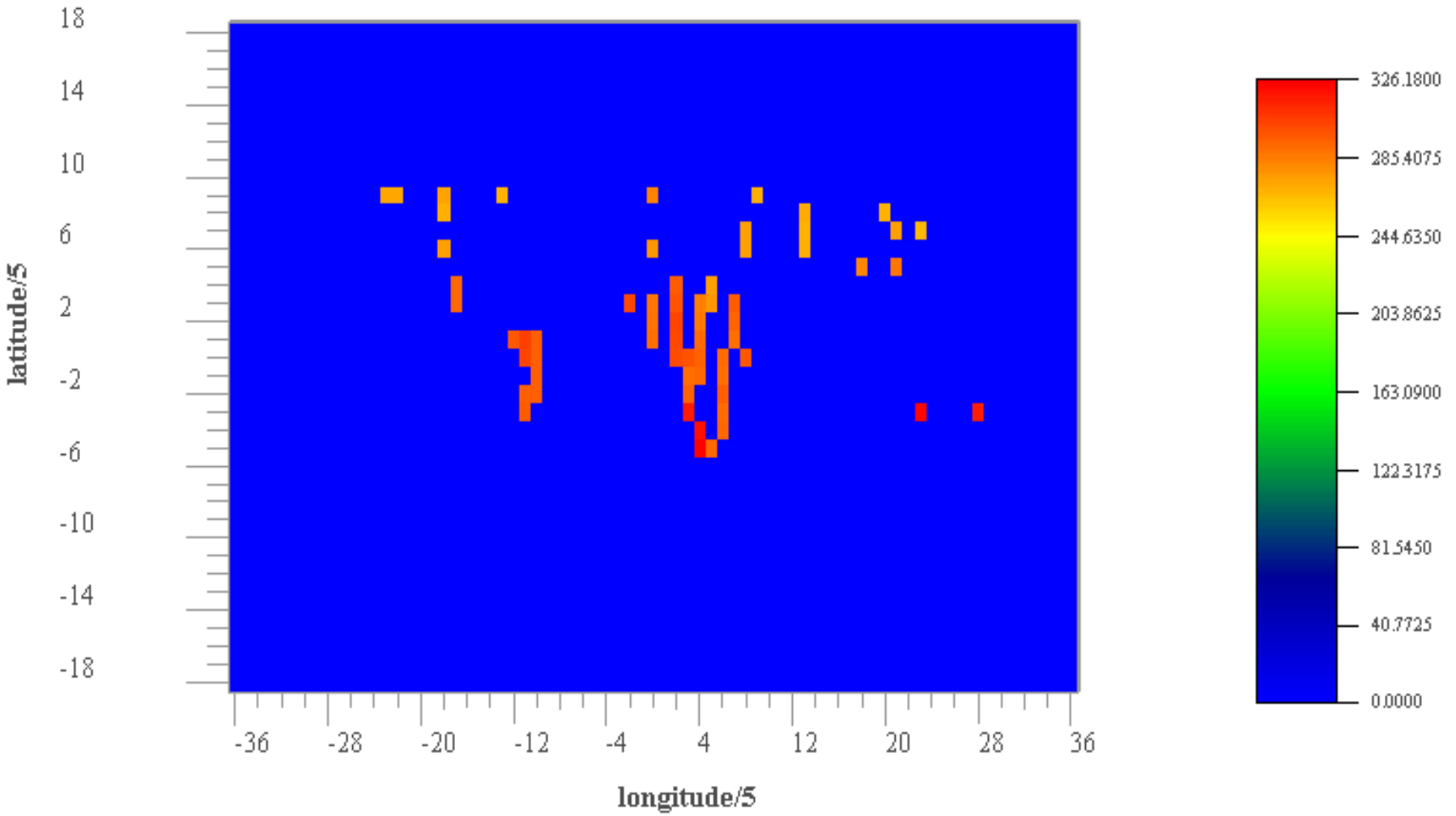
Channel 15 (measured – calculated difference) spot 1 on the left



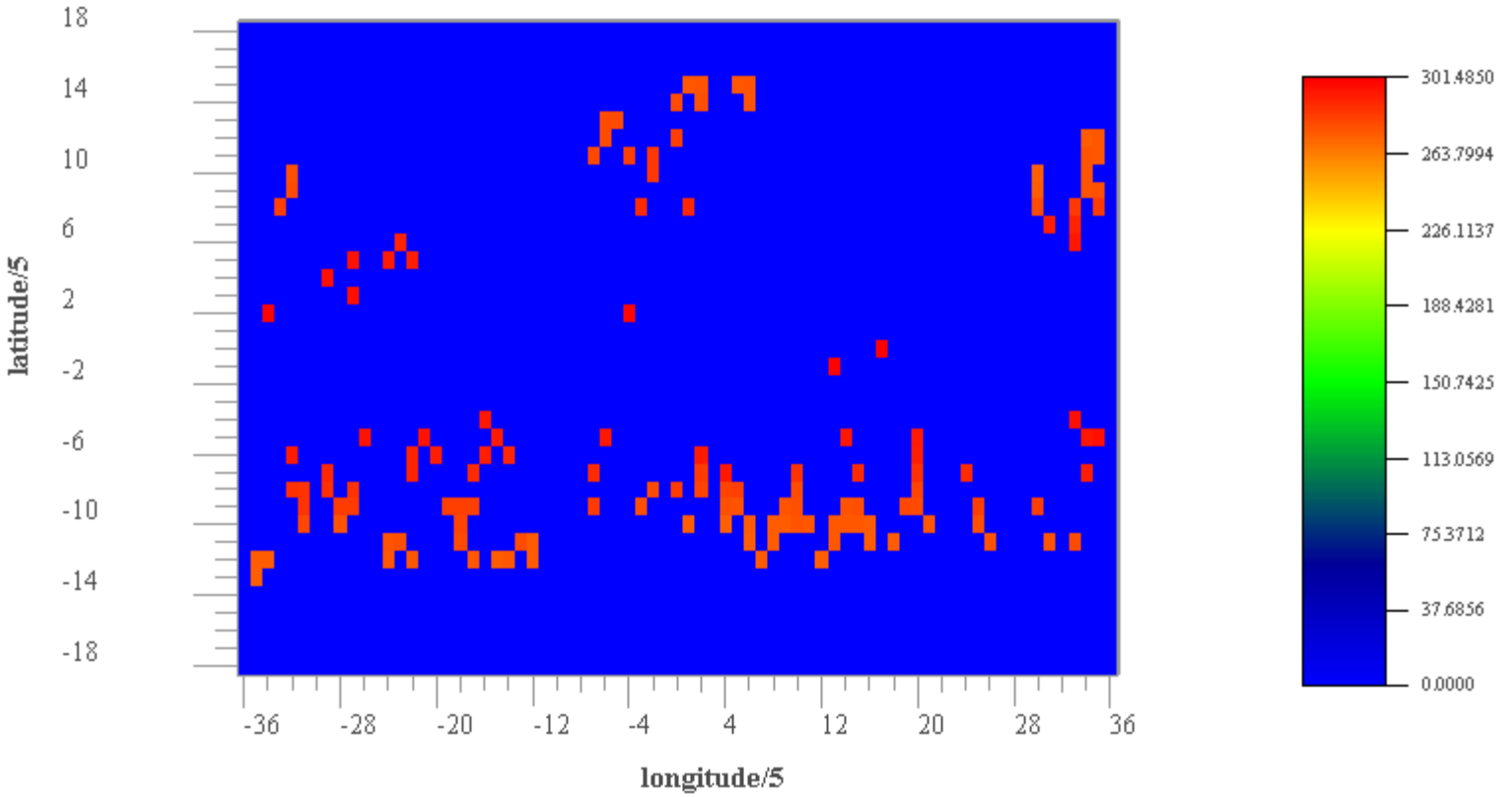
Slide Description

- The next 2 slides show typical locations for the comparisons

Typical Land locations



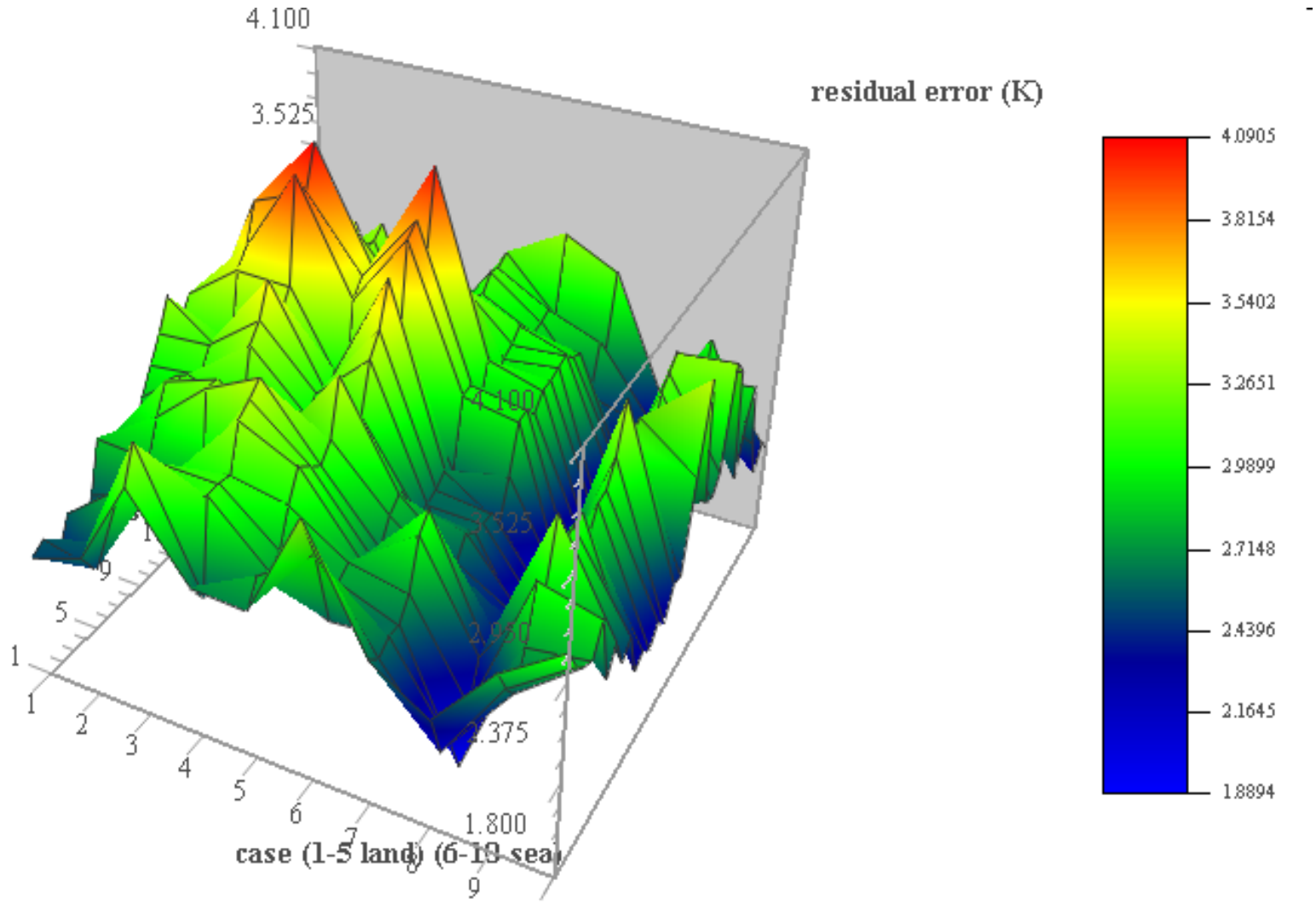
Typical Sea locations



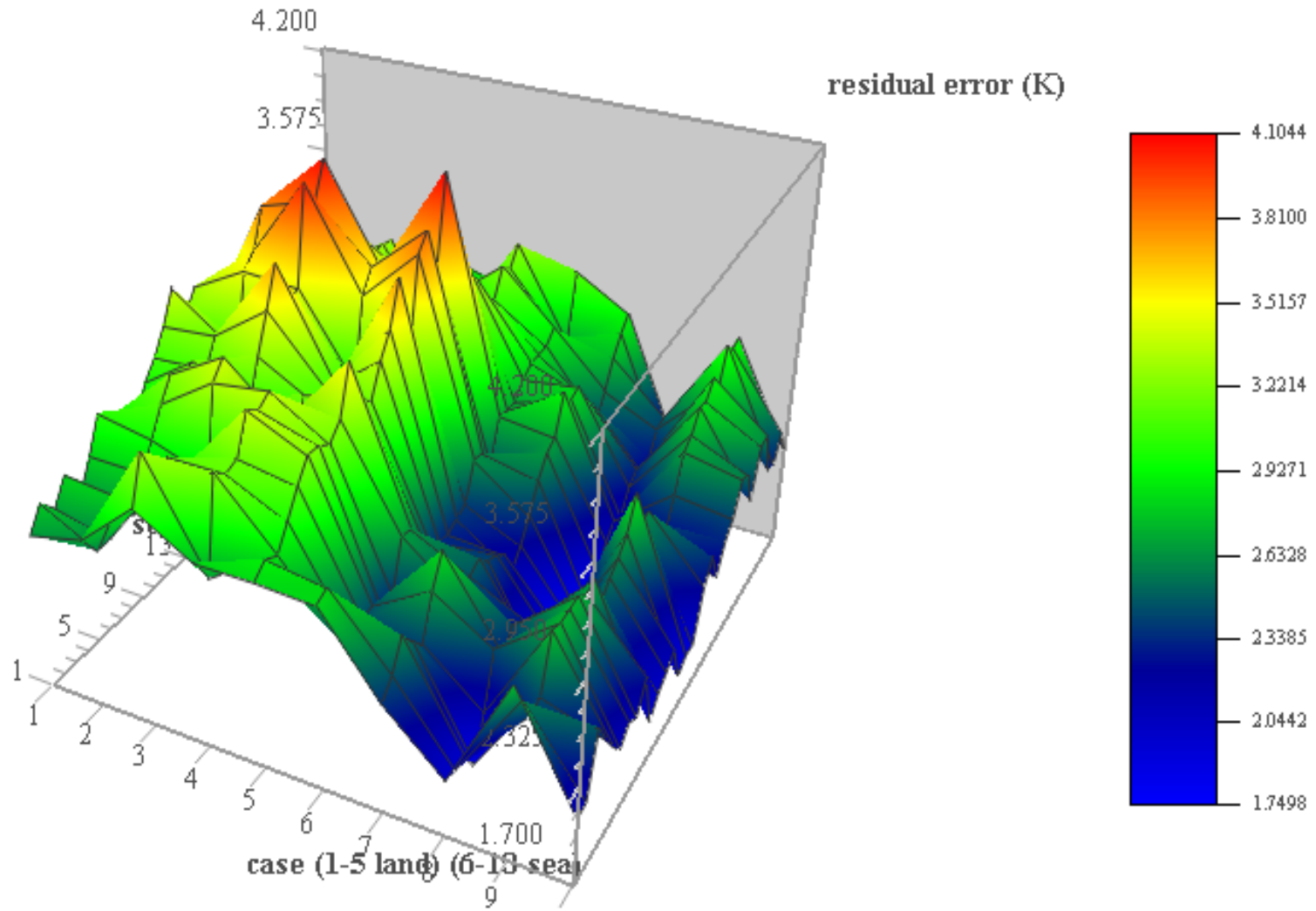
Slide Description

- The next 15 slides show the residual errors after the adjustments have been applied
  - Adjustment is the mean difference for the spot plus the 15 channel values plus the spot number plus the sin and cos of the latitude
- The first five cases are the focus days over land (Sept. 9-02, Sept. 29-02 Nov. 11-02, March 1-03, March 20-03, and April 9-03).
- The next five cases are the same days over sea.

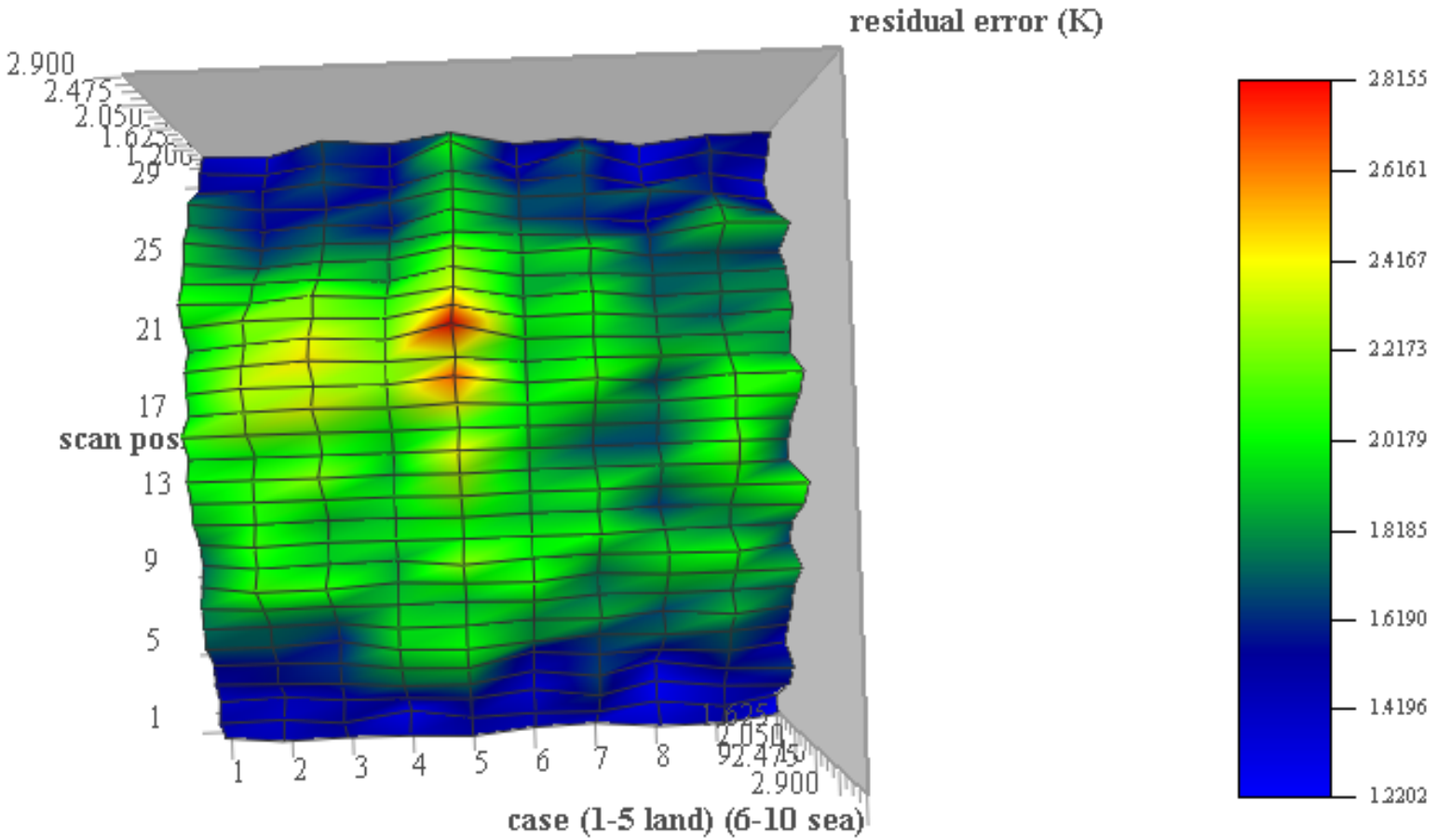
Channel 1 Residual Error (K)



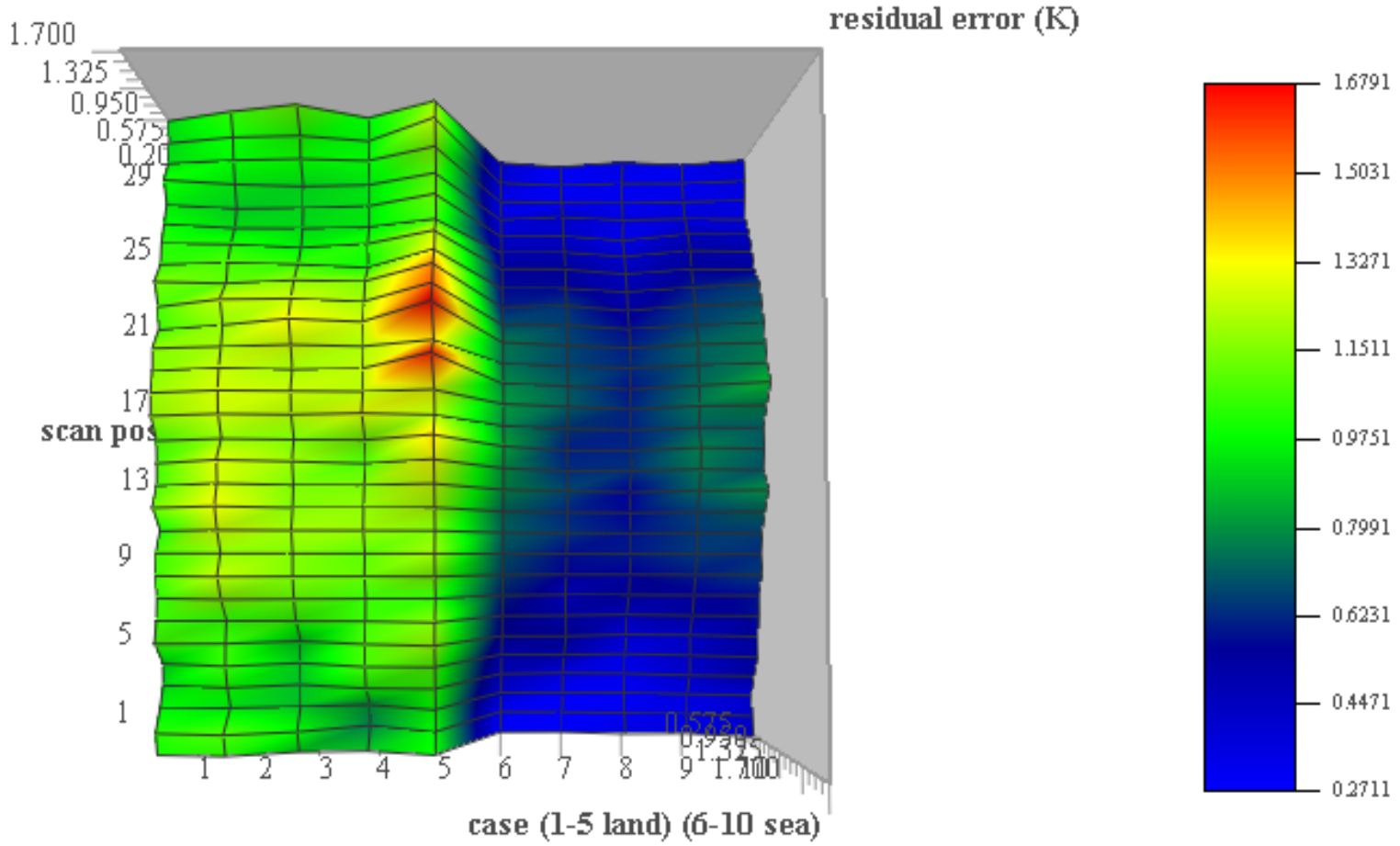
Channel 2 Residual Error (K)



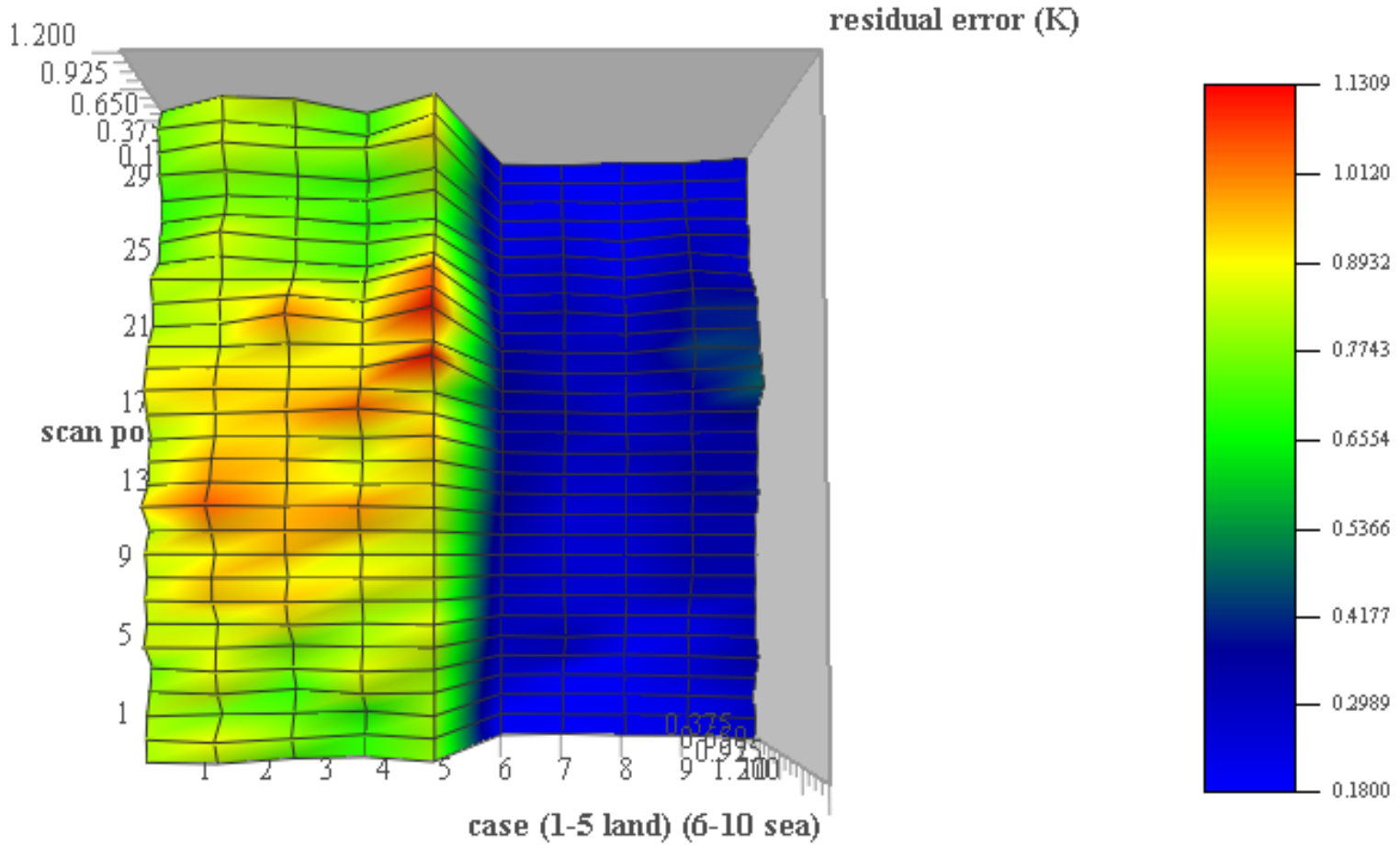
Channel 3 Residual Error (K)



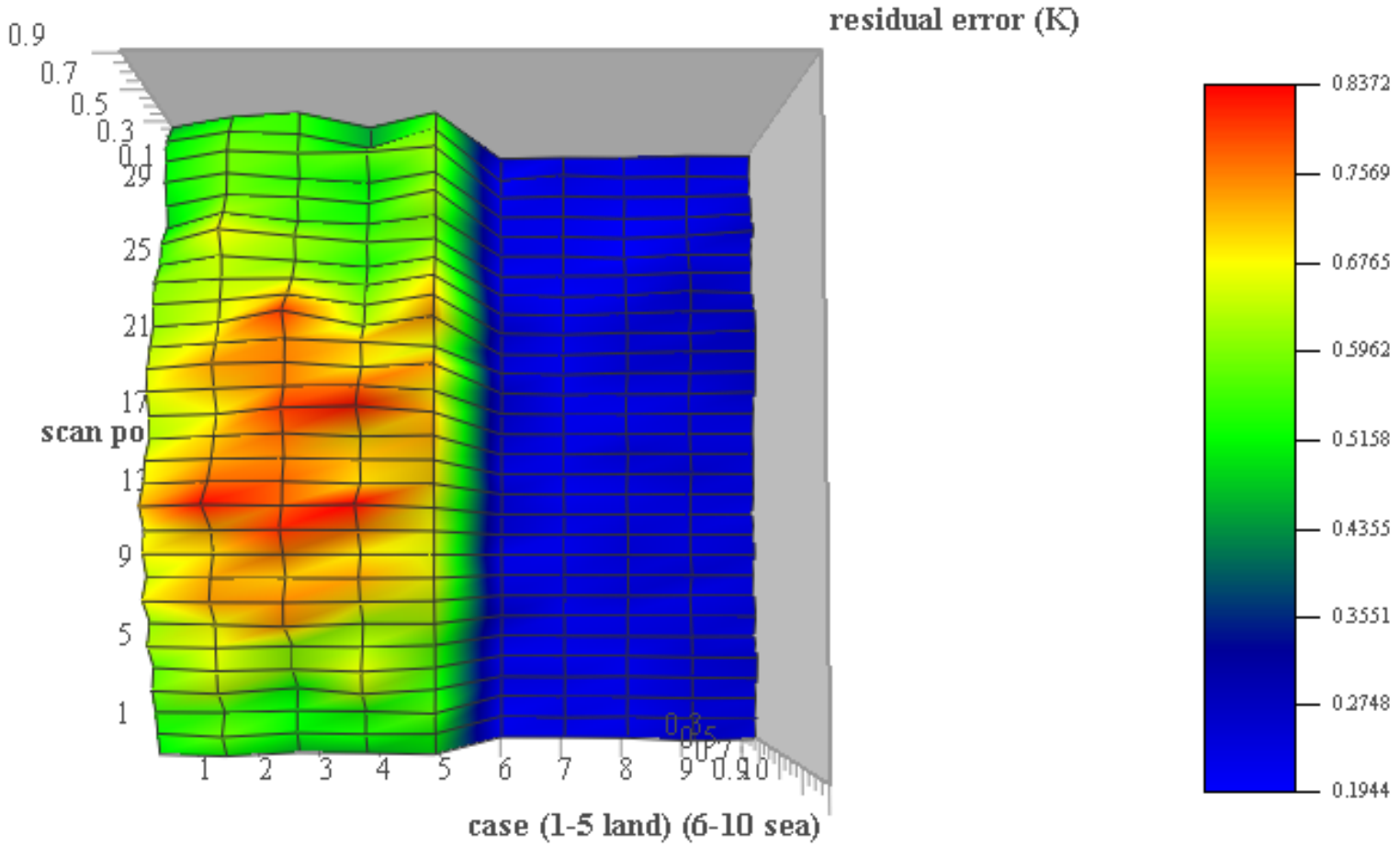
Channel 4 Residual Error (K)



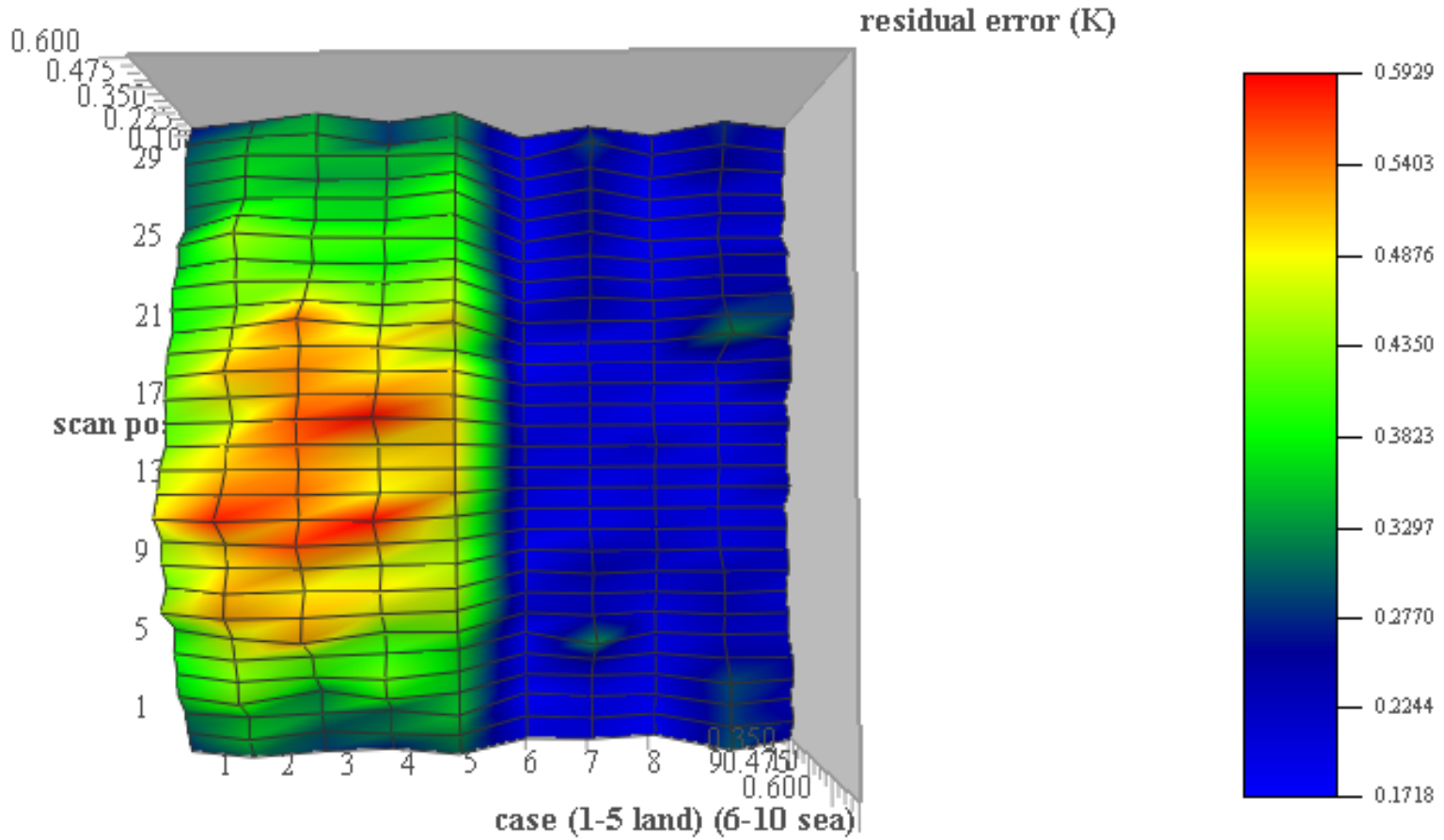
Channel 5 Residual Error (K)



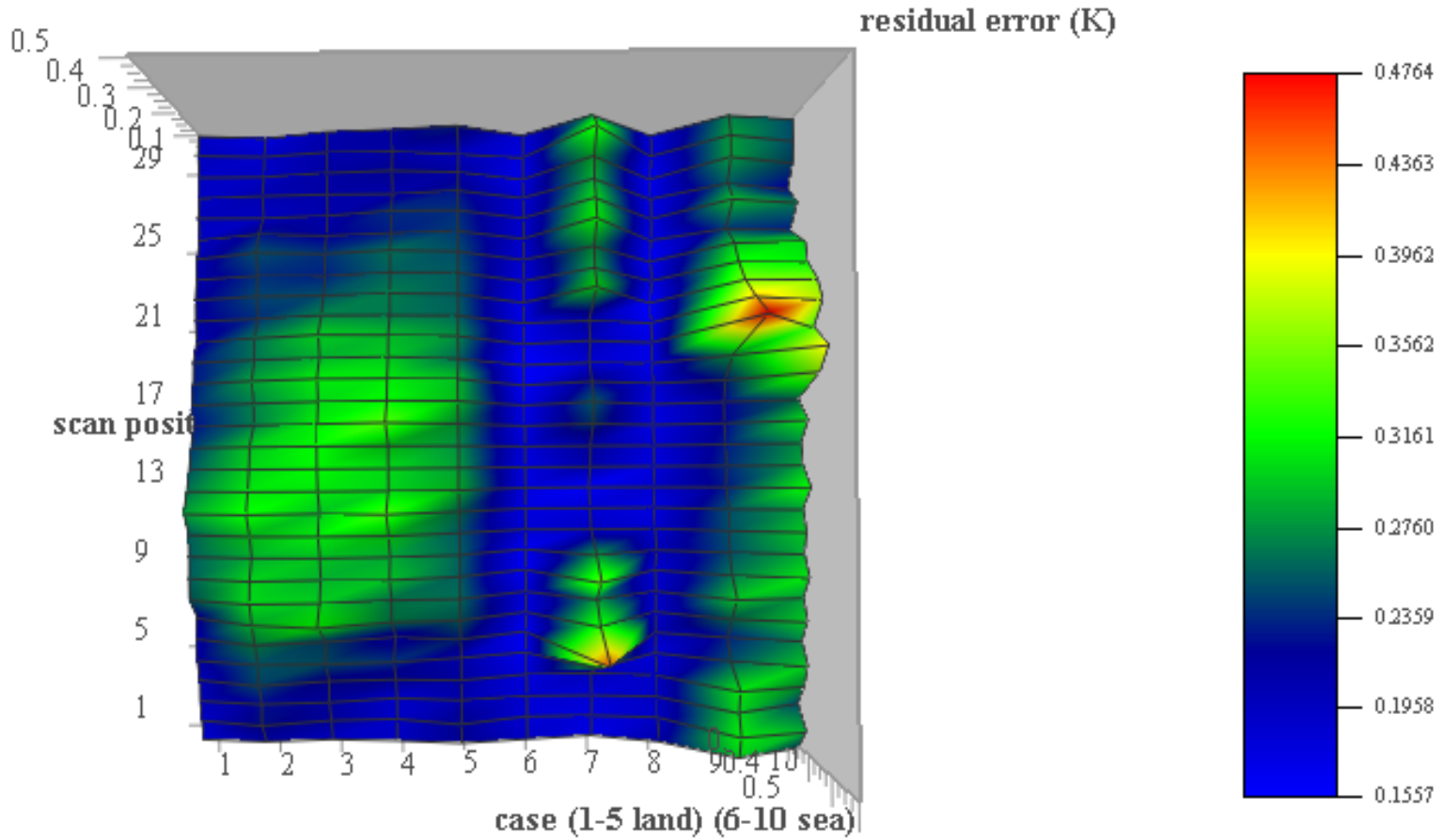
Channel 6 Residual Error (K)



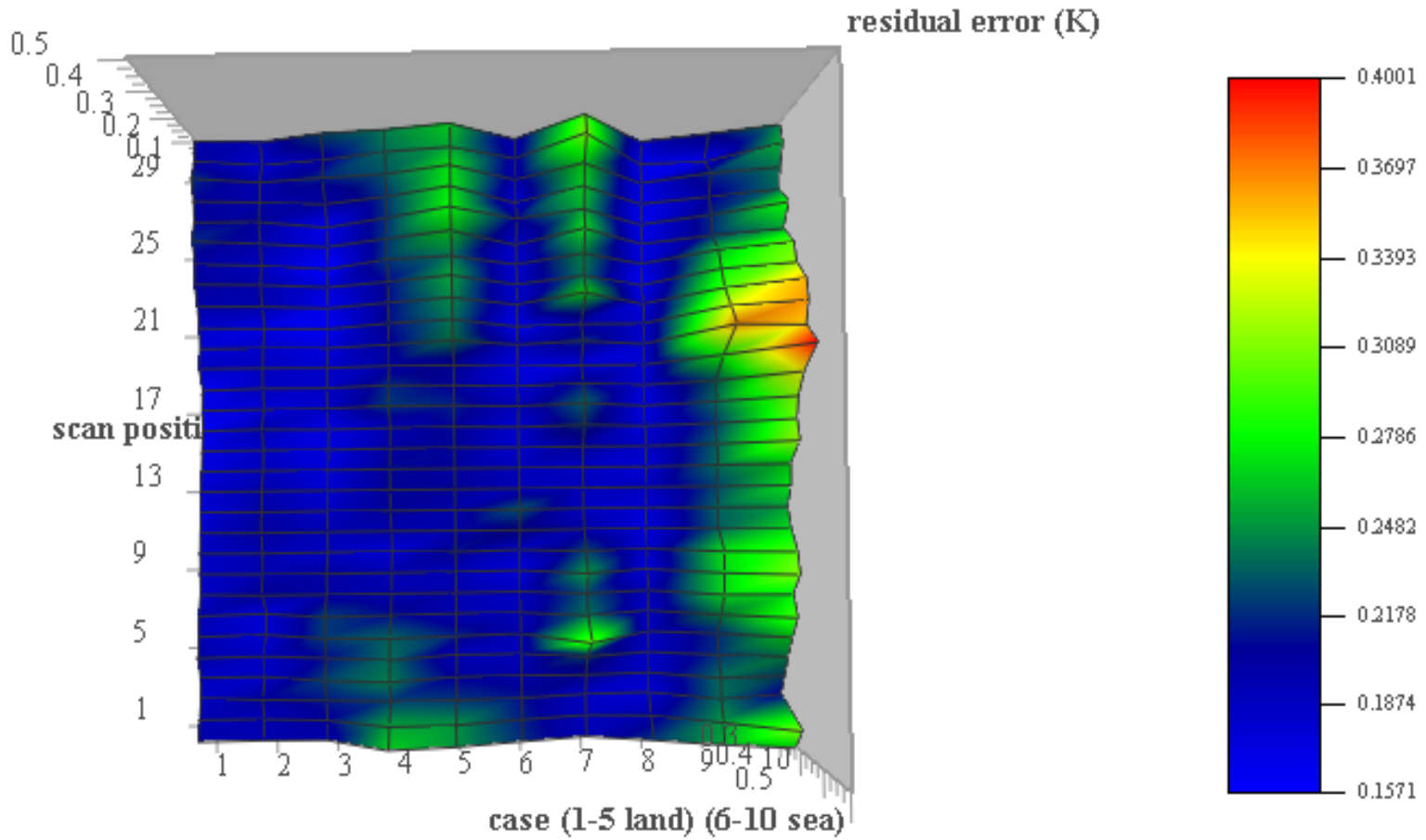
Channel 7 Residual Error (K)



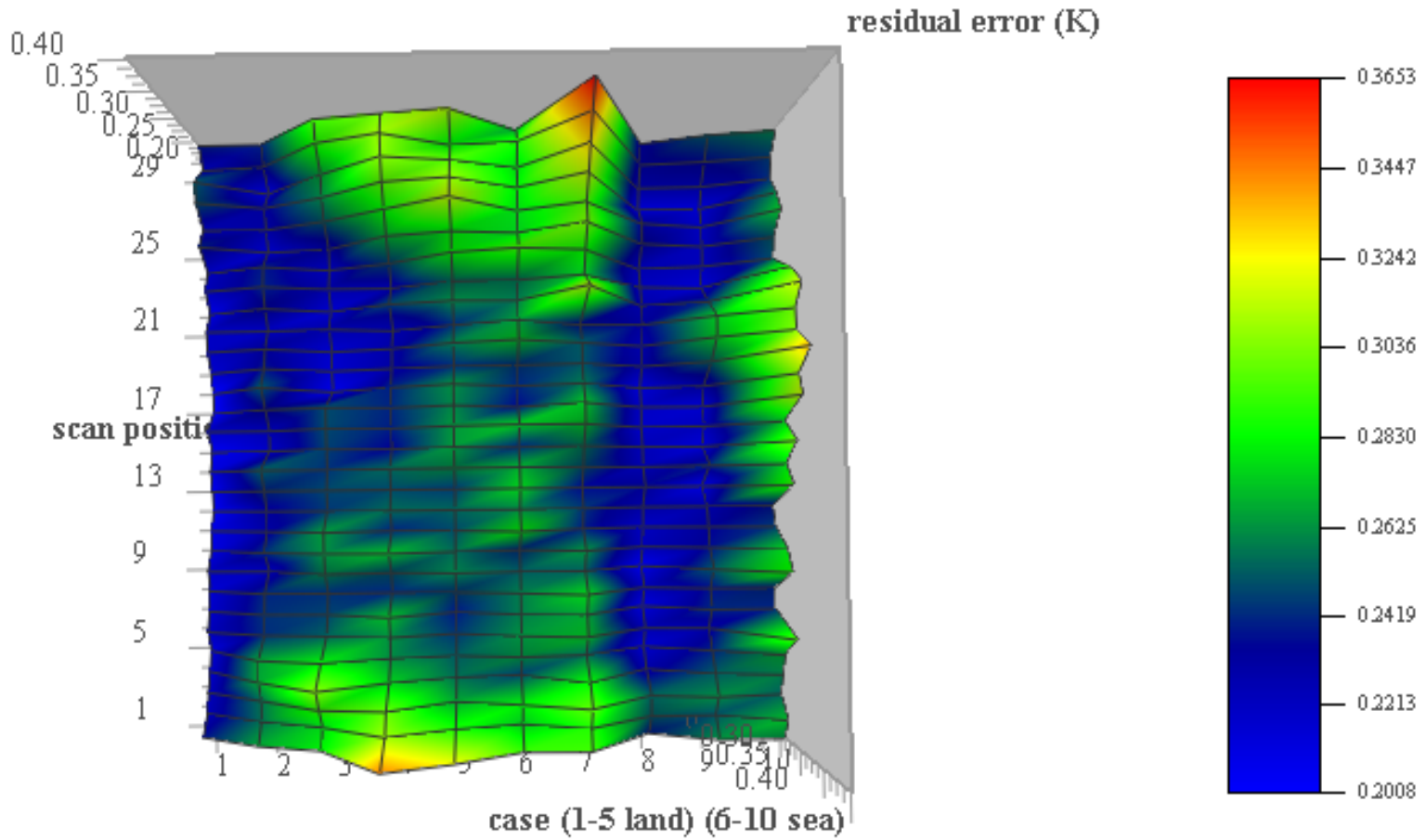
Channel 8 Residual Error (K)



Channel 9 Residual Error (K)



Channel 10 Residual Error (K)



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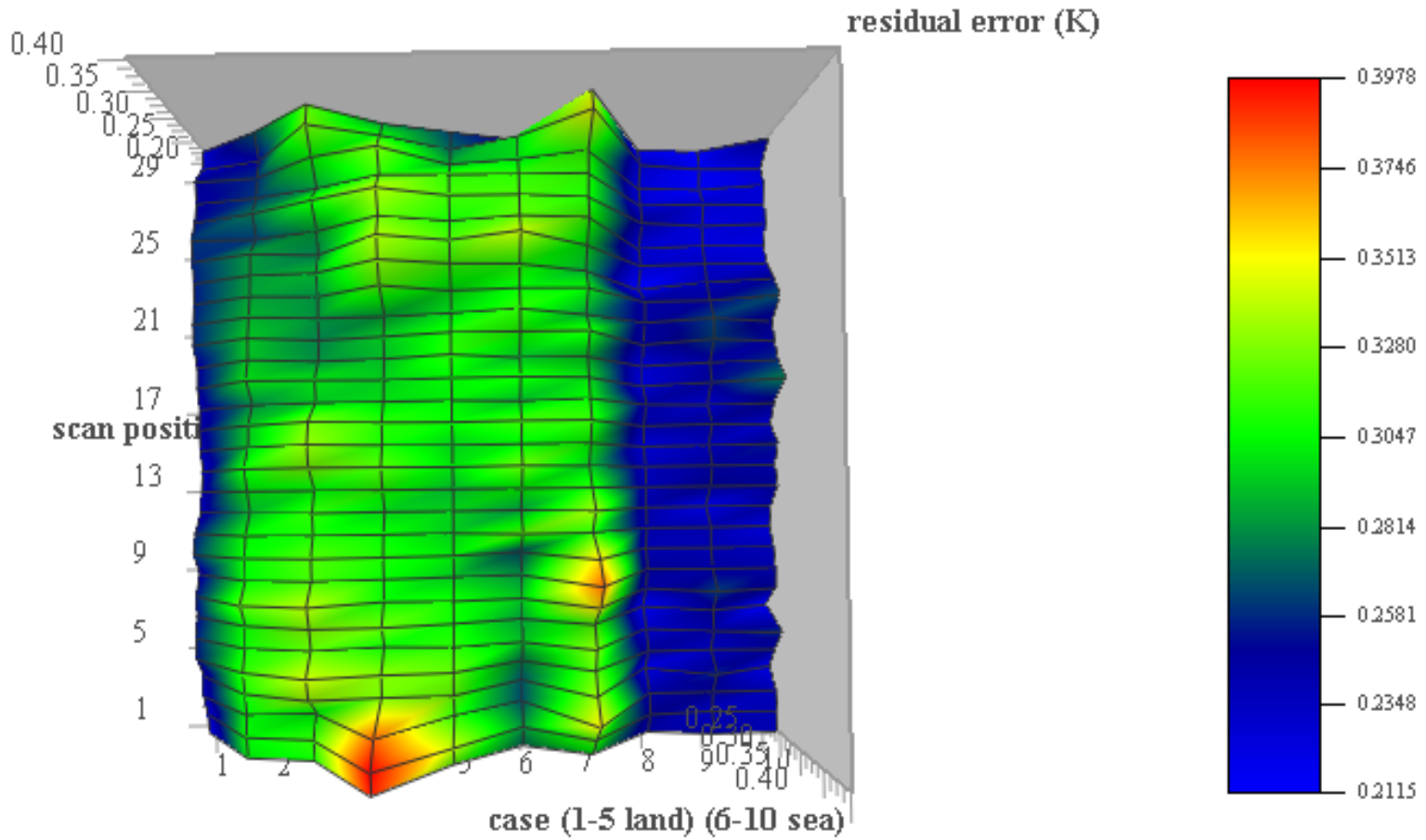
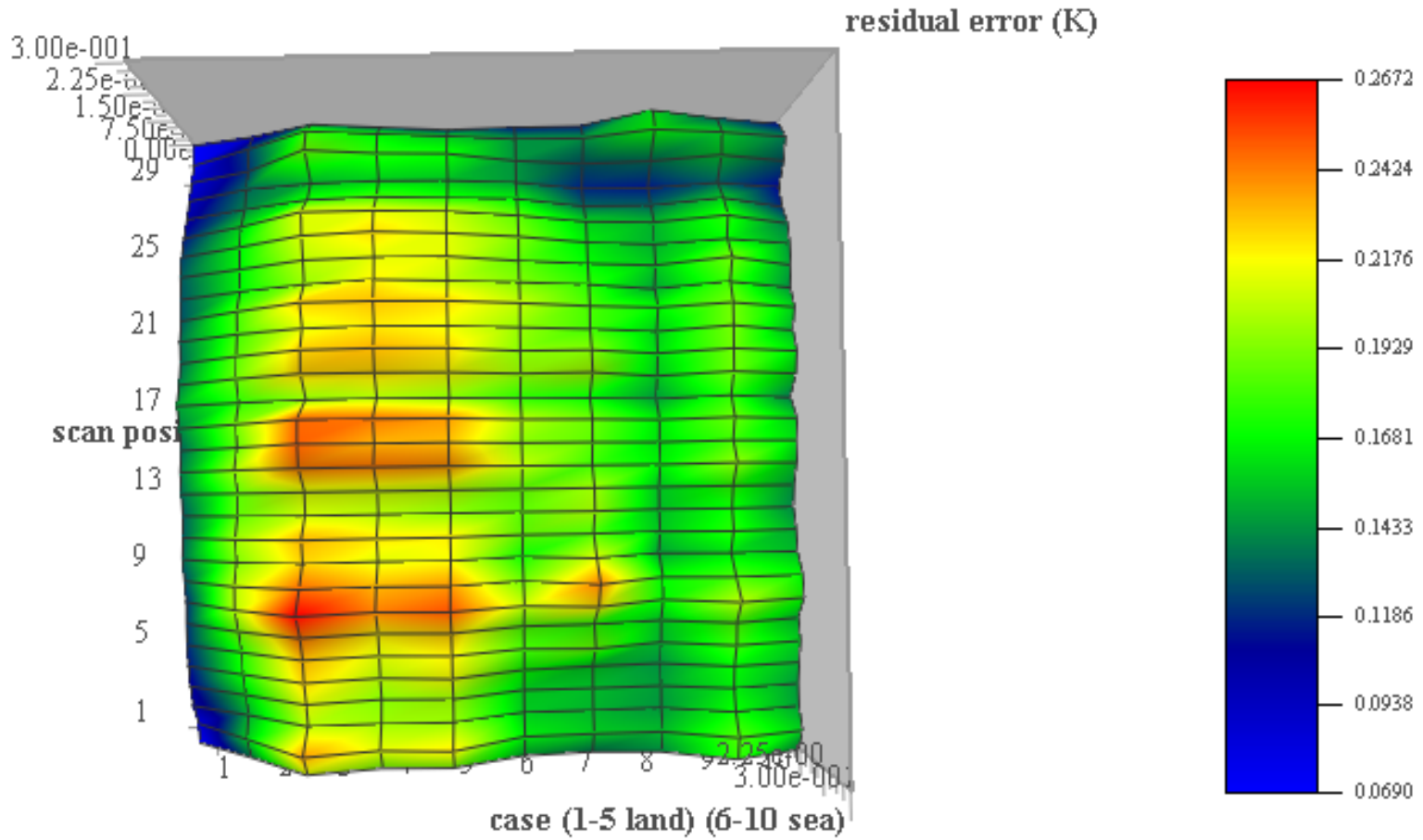
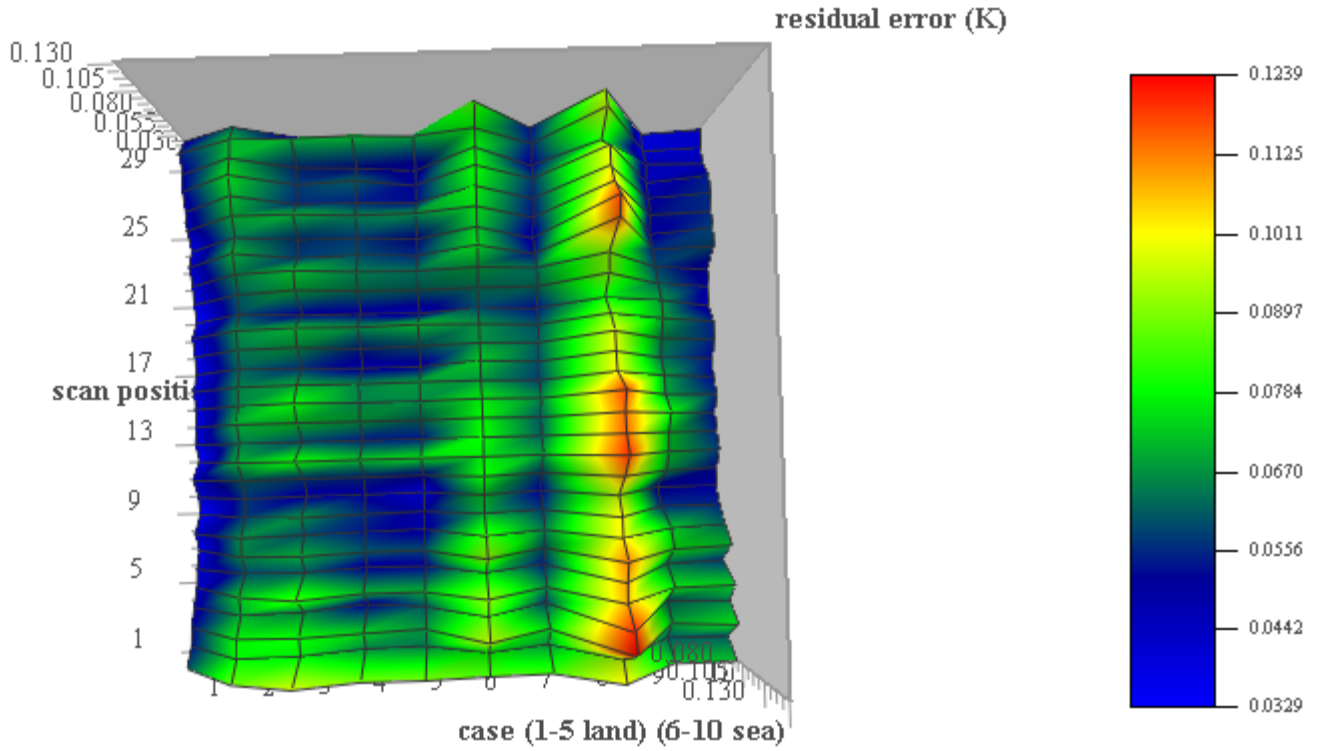
Channel 11 Residual Error (K)



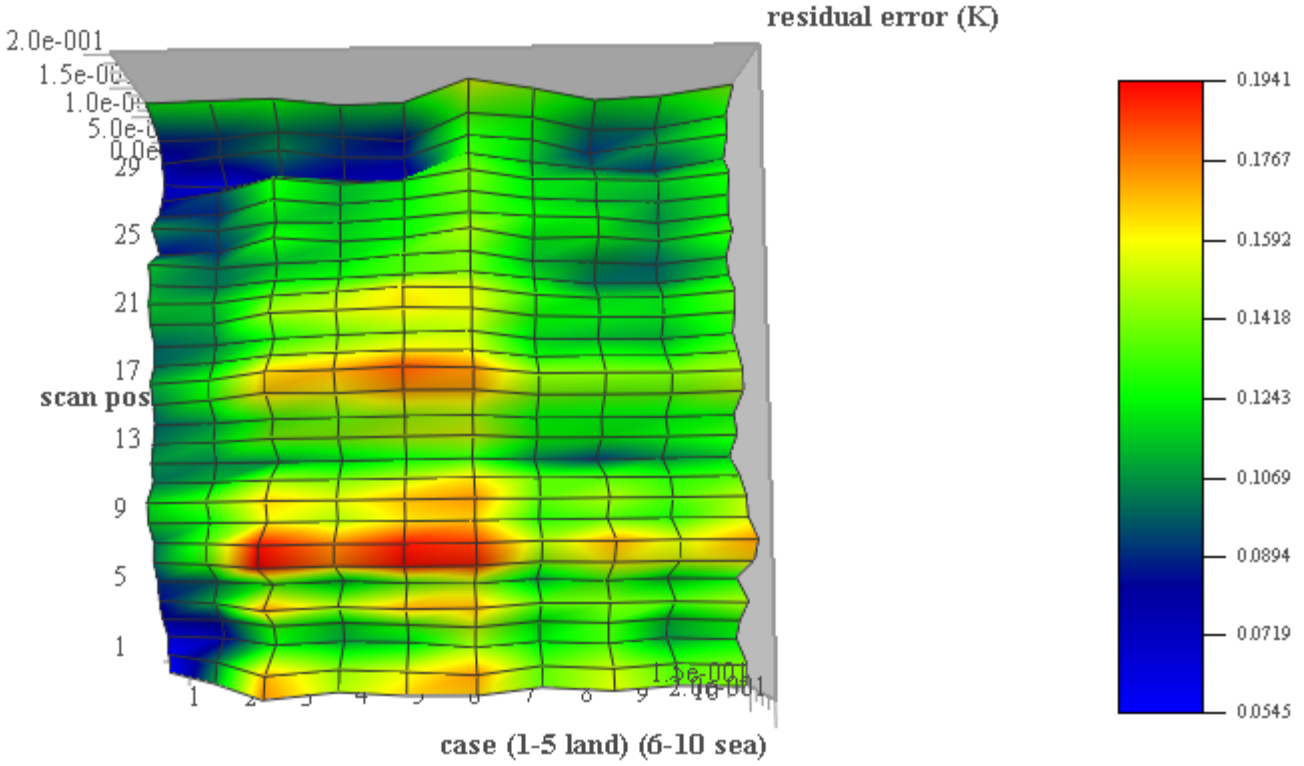
Channel 12 Residual Error (K)



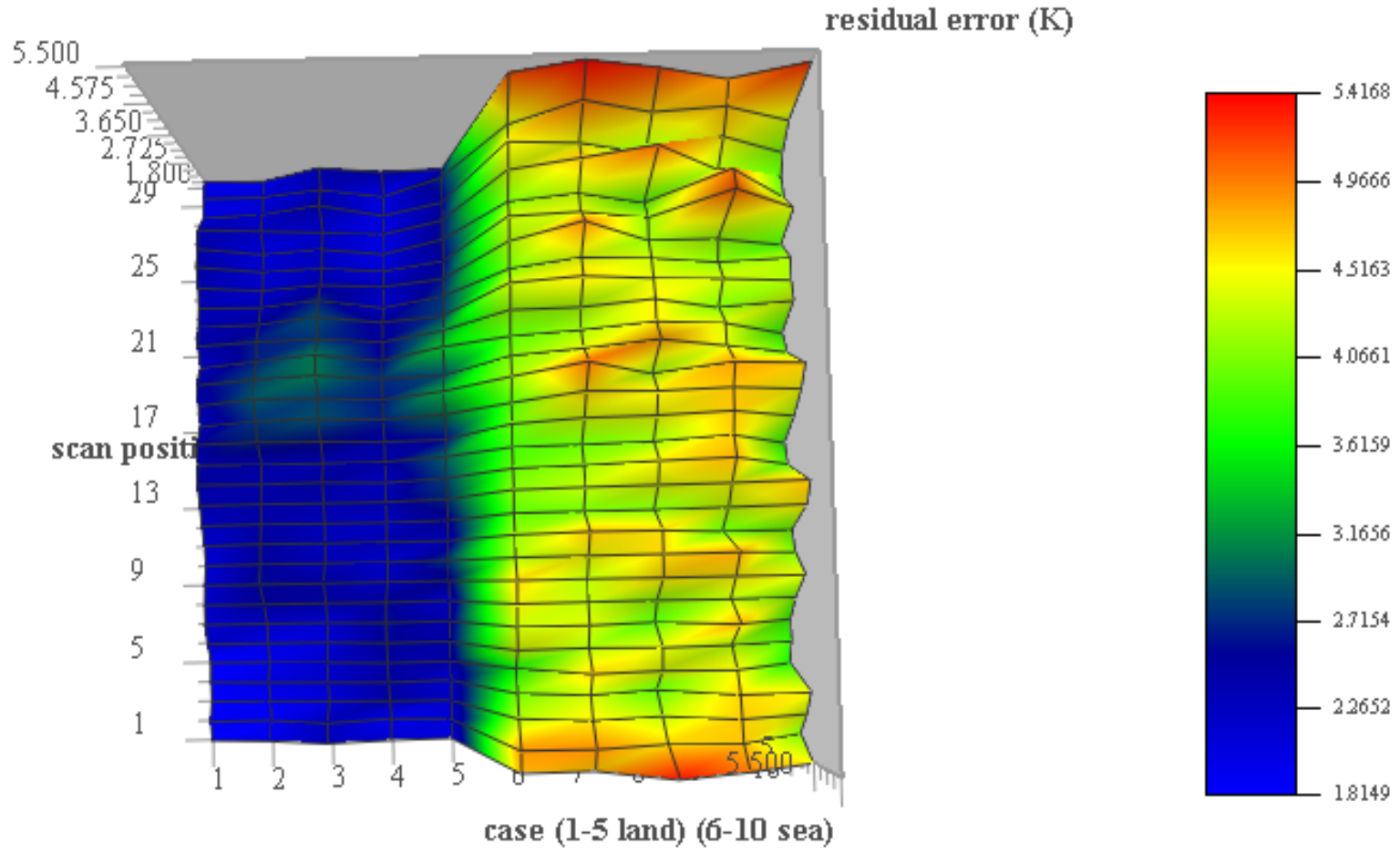
Channel 13 Residual Error (K)



Channel 14 Residual Error (K)



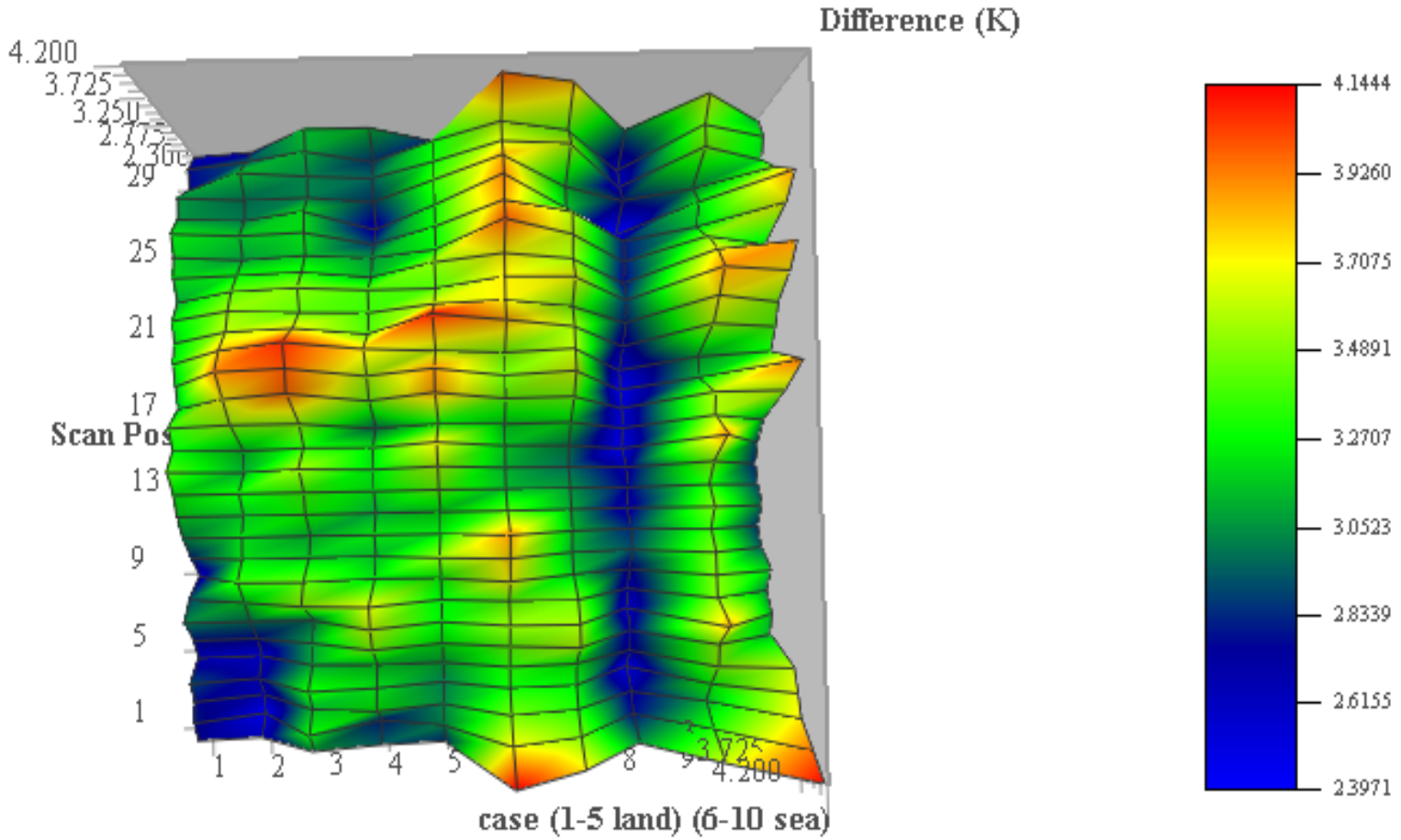
Channel 15 Residual Error (K)



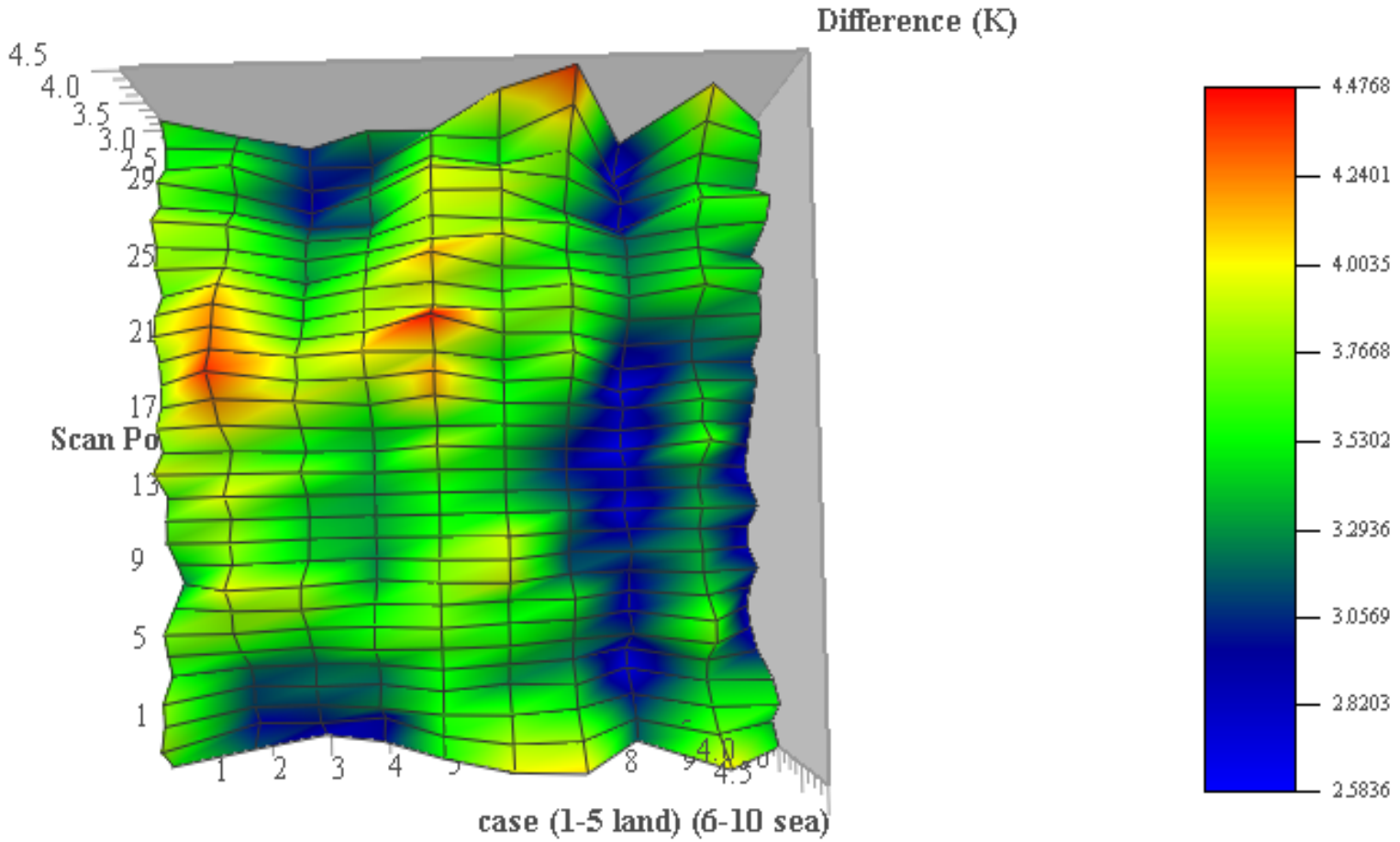
Slide Description

- The next 15 slides show the residual errors after the adjustments for just the mean difference have been applied
  - Adjustment is just the mean difference for the spot p
- The first five cases are the focus days over land (Sept. 9-02, Sept. 29-02 Nov. 11-02, March 1-03, March 20-03, and April 9-03).
- The next five cases are the same days over sea.

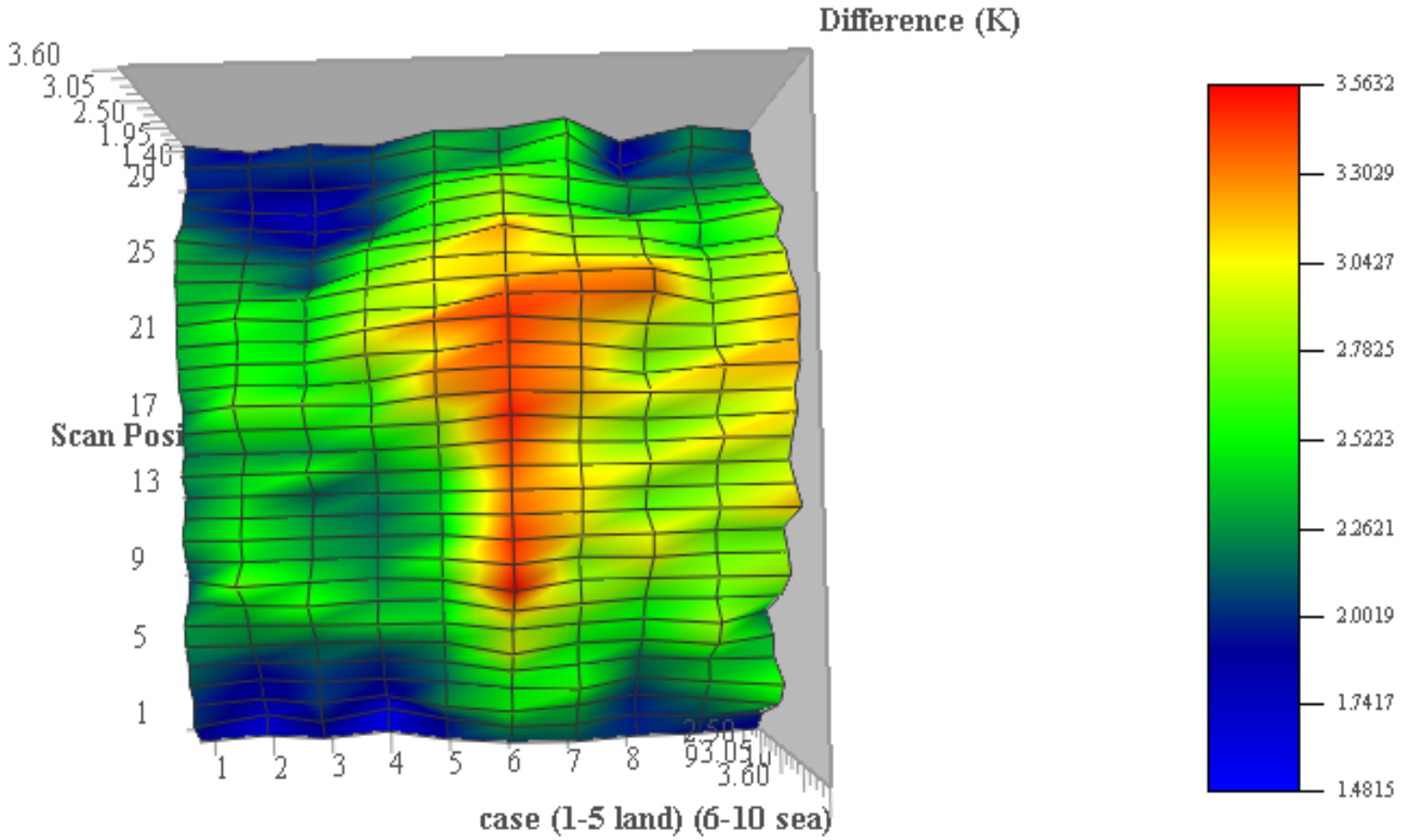
Channel 1 bias only Residual Error (K)



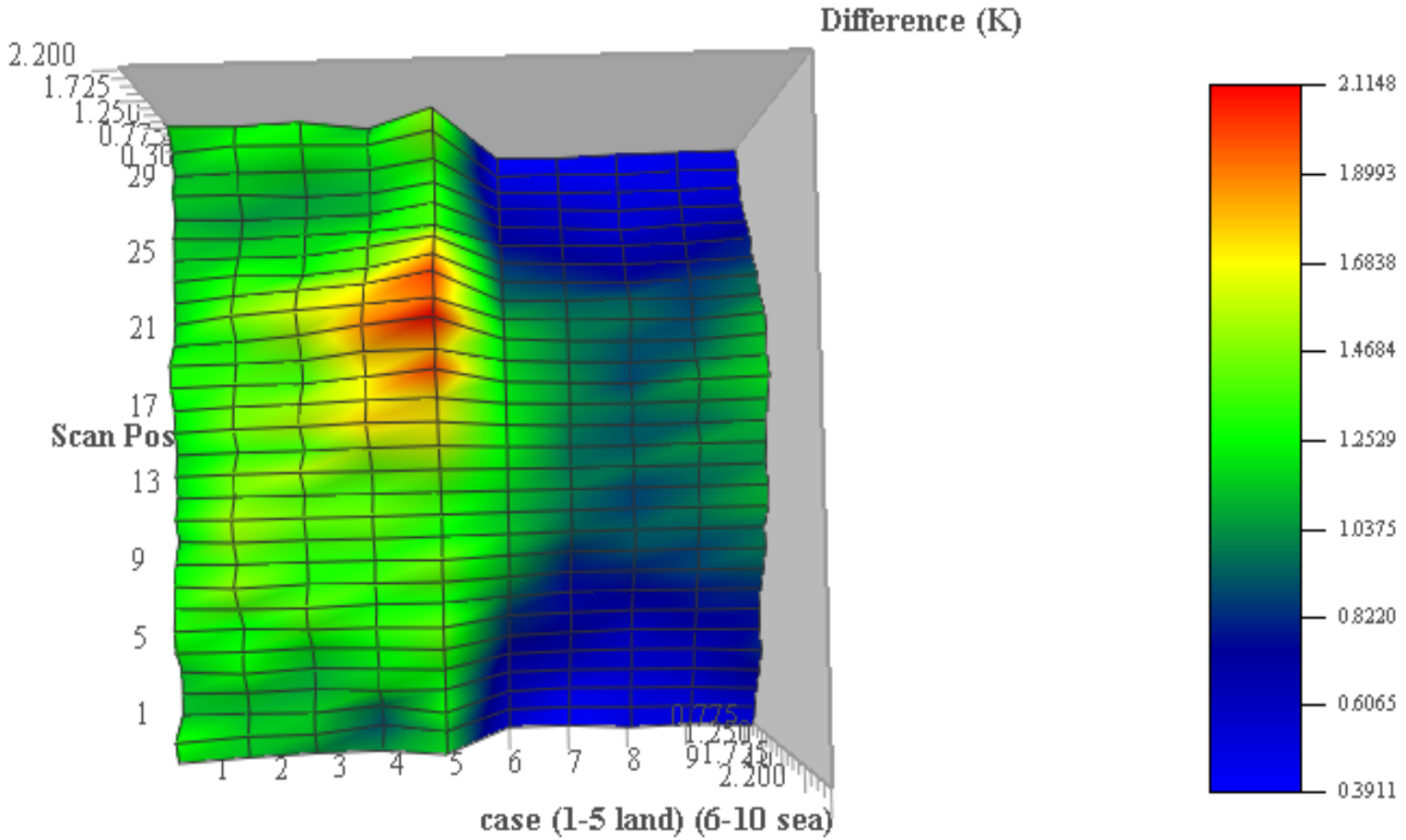
Channel 2 bias only Residual Error (K)



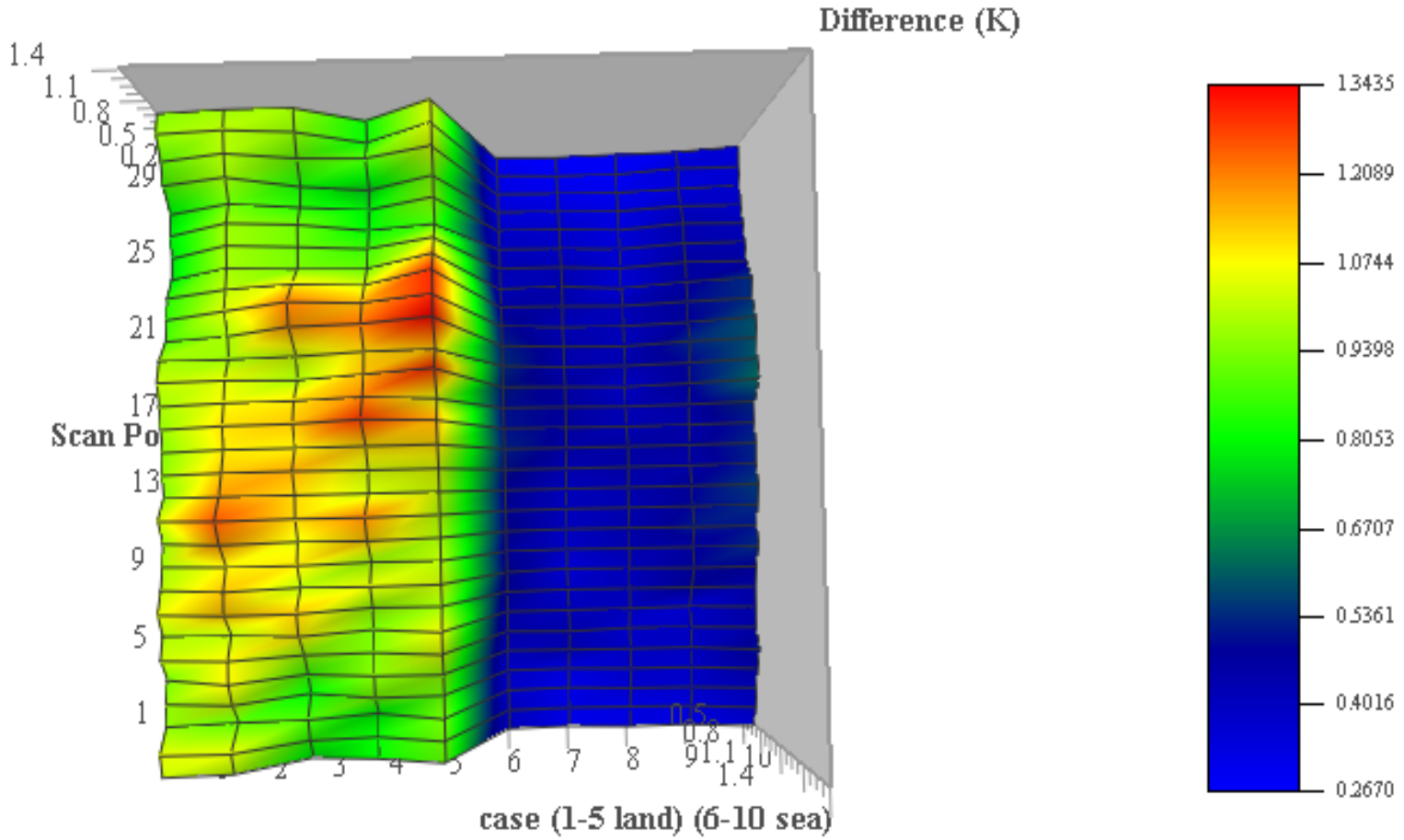
Channel 3 bias only Residual Error (K)



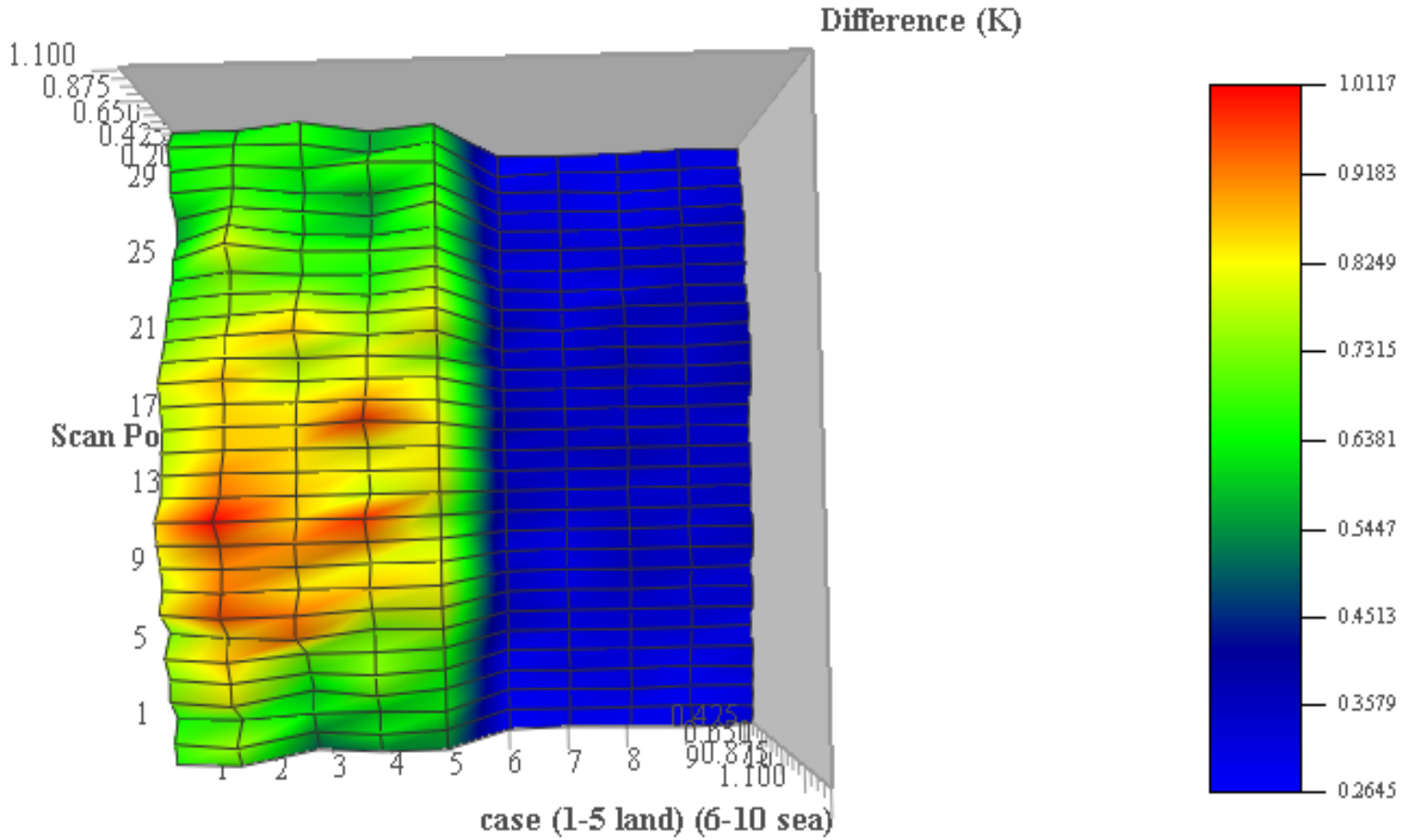
Channel 4 bias only Residual Error (K)



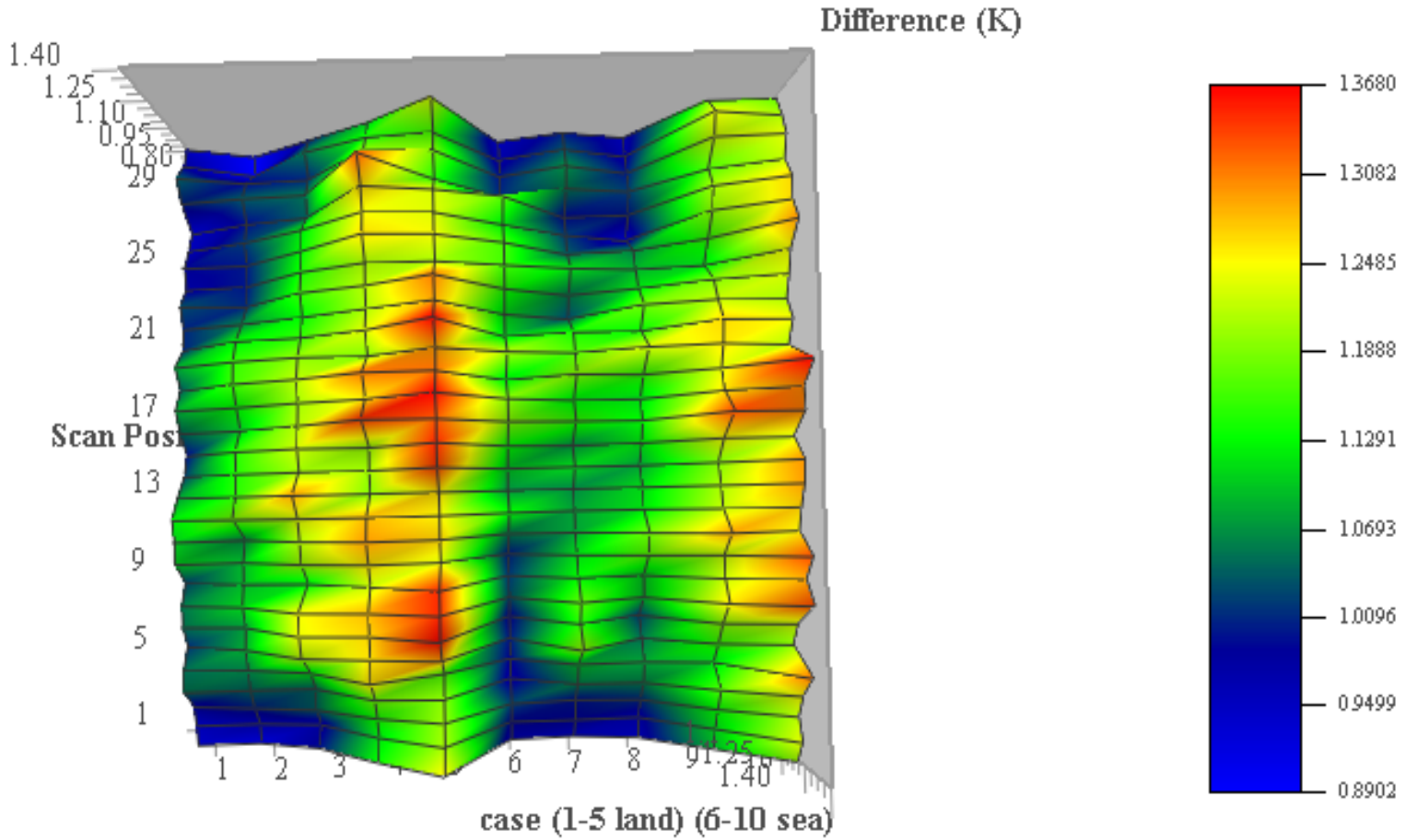
Channel 5 bias only Residual Error (K)



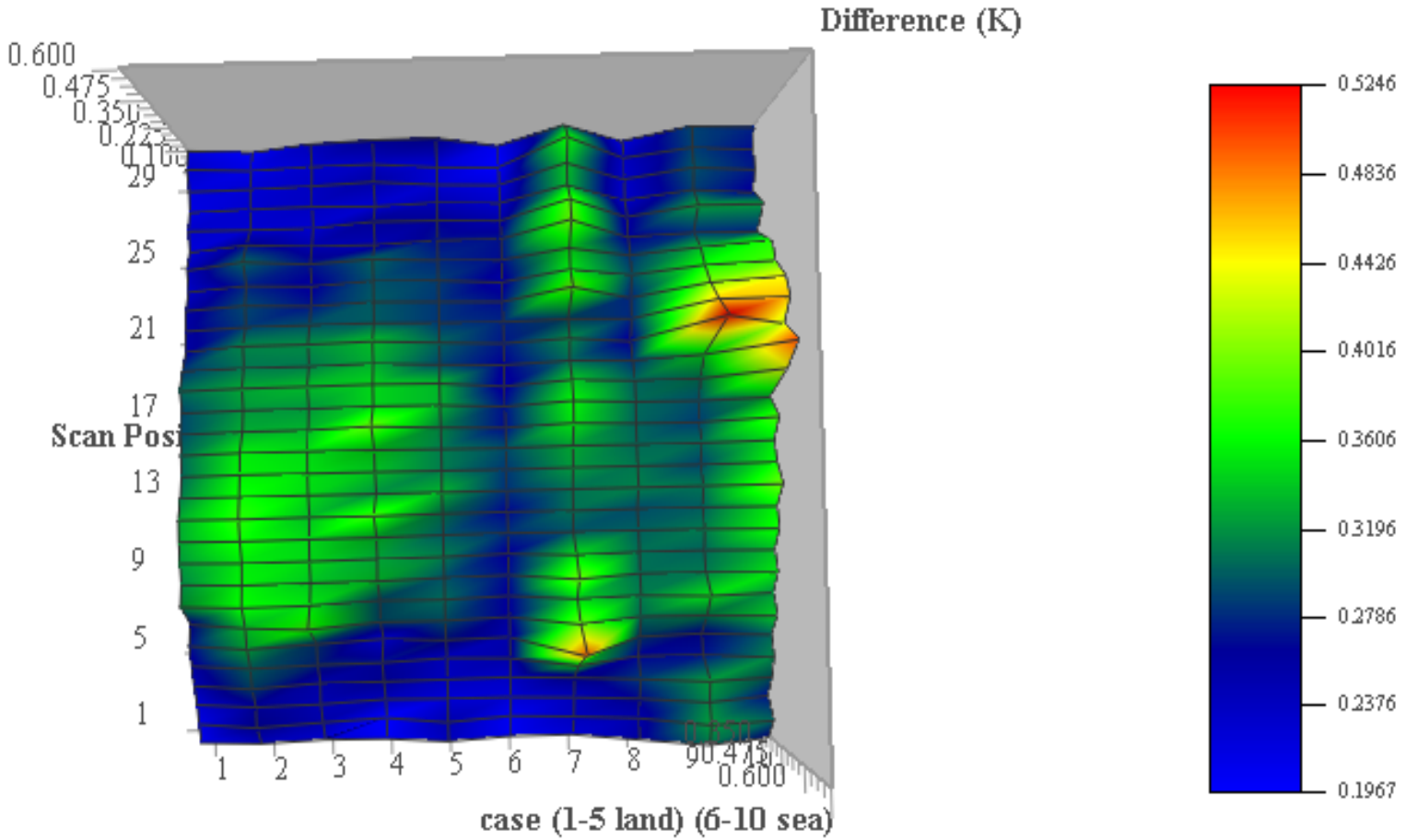
Channel 6 bias only Residual Error (K)



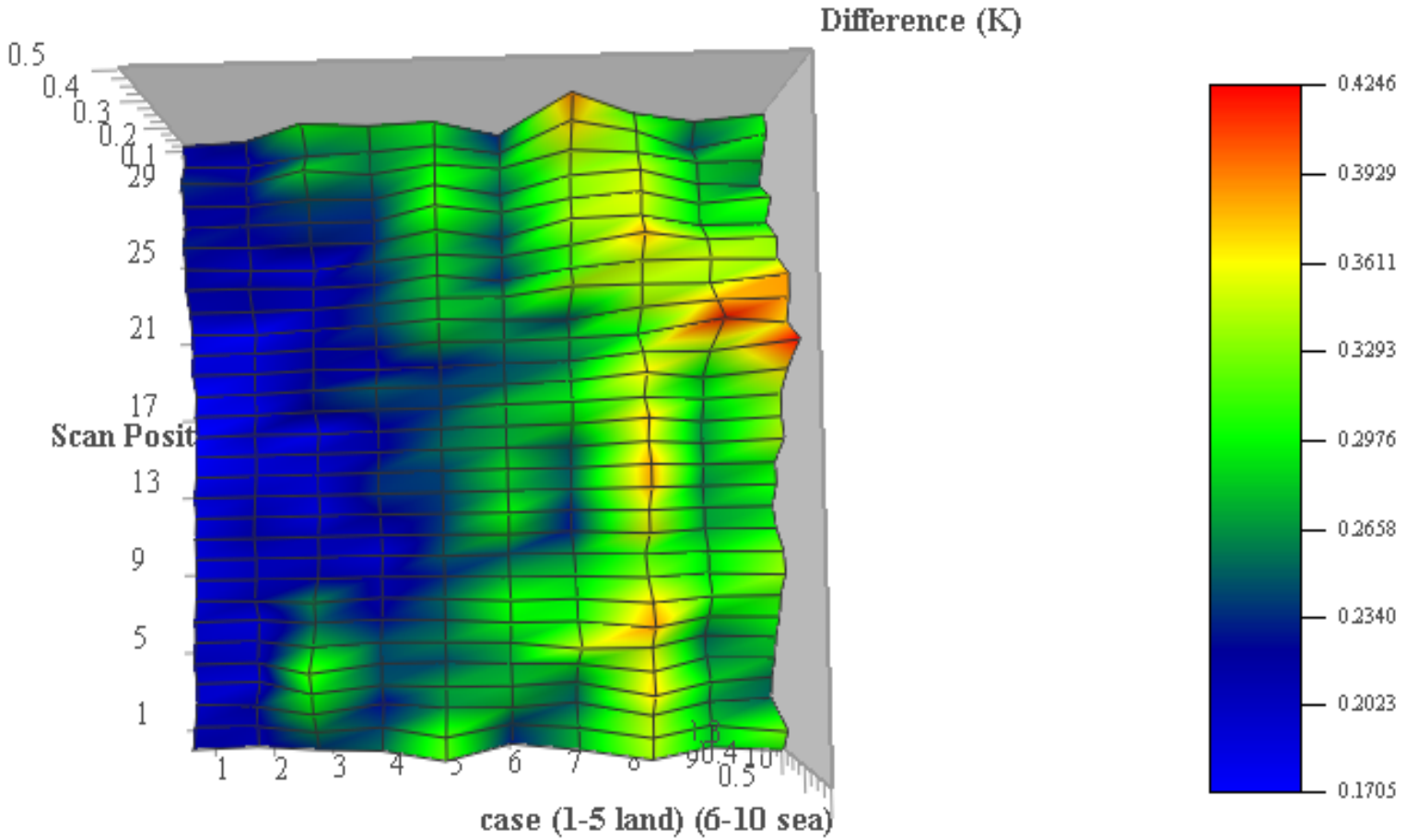
Channel 7 bias only Residual Error (K)



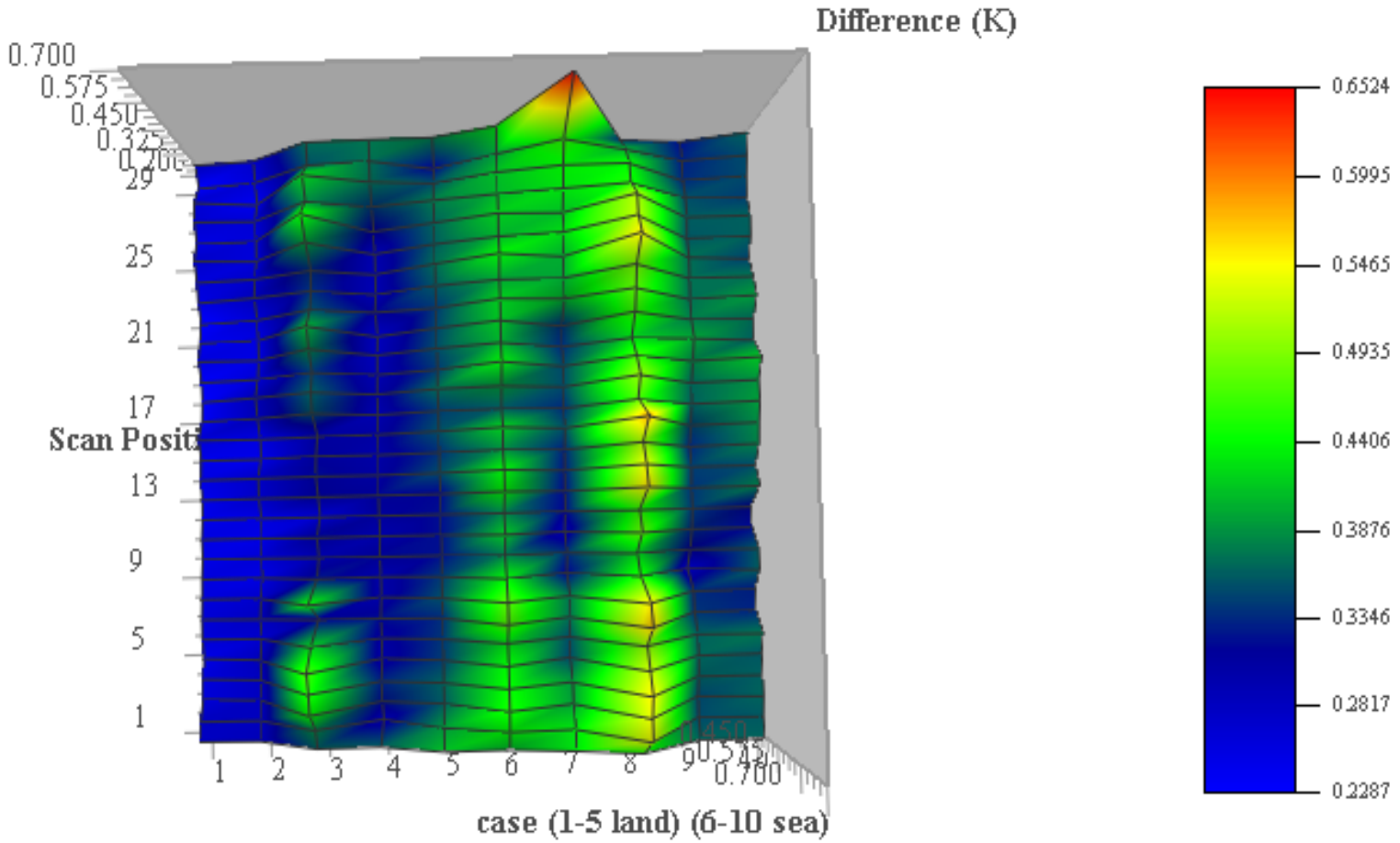
Channel 8 bias only Residual Error (K)



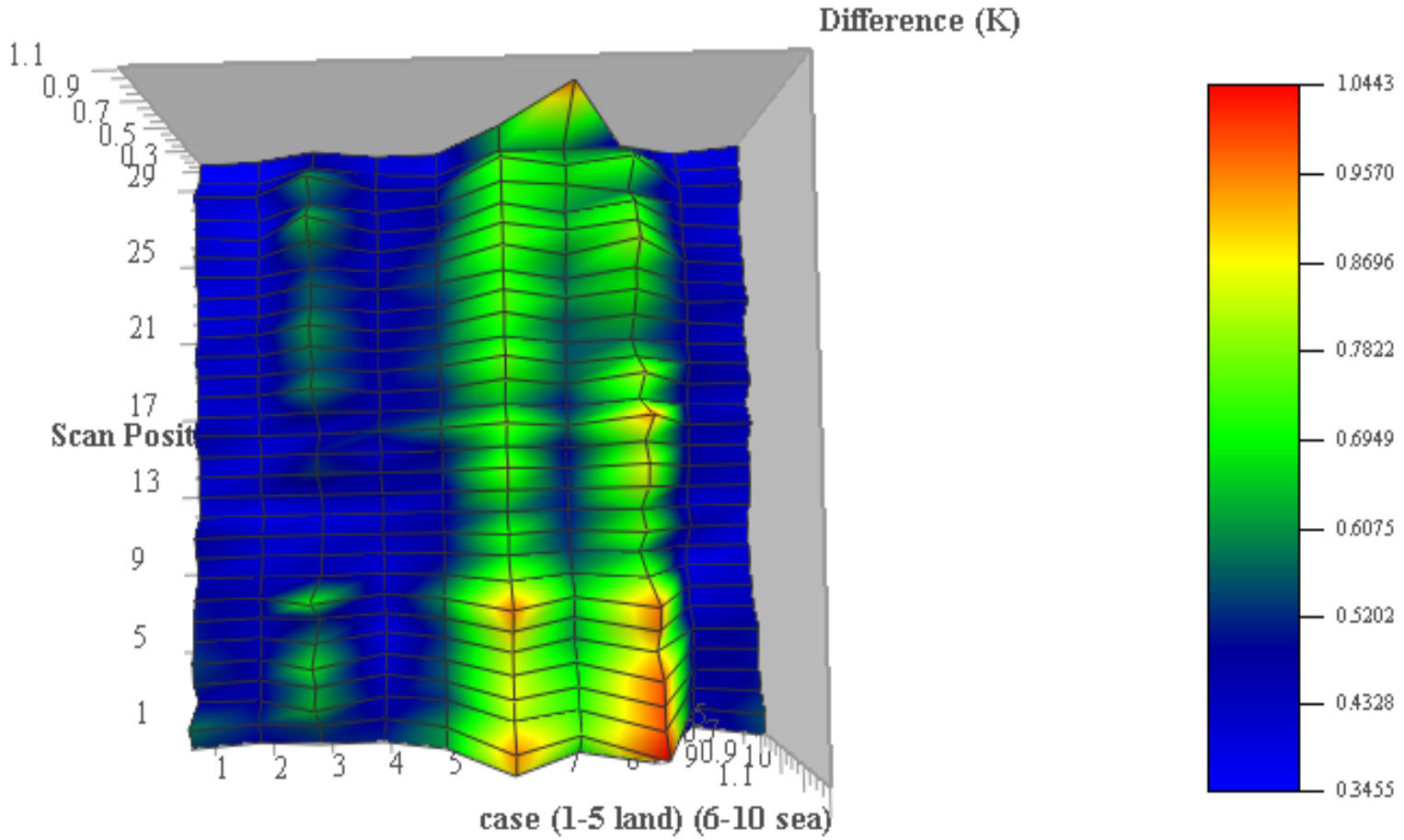
Channel 9 bias only Residual Error (K)



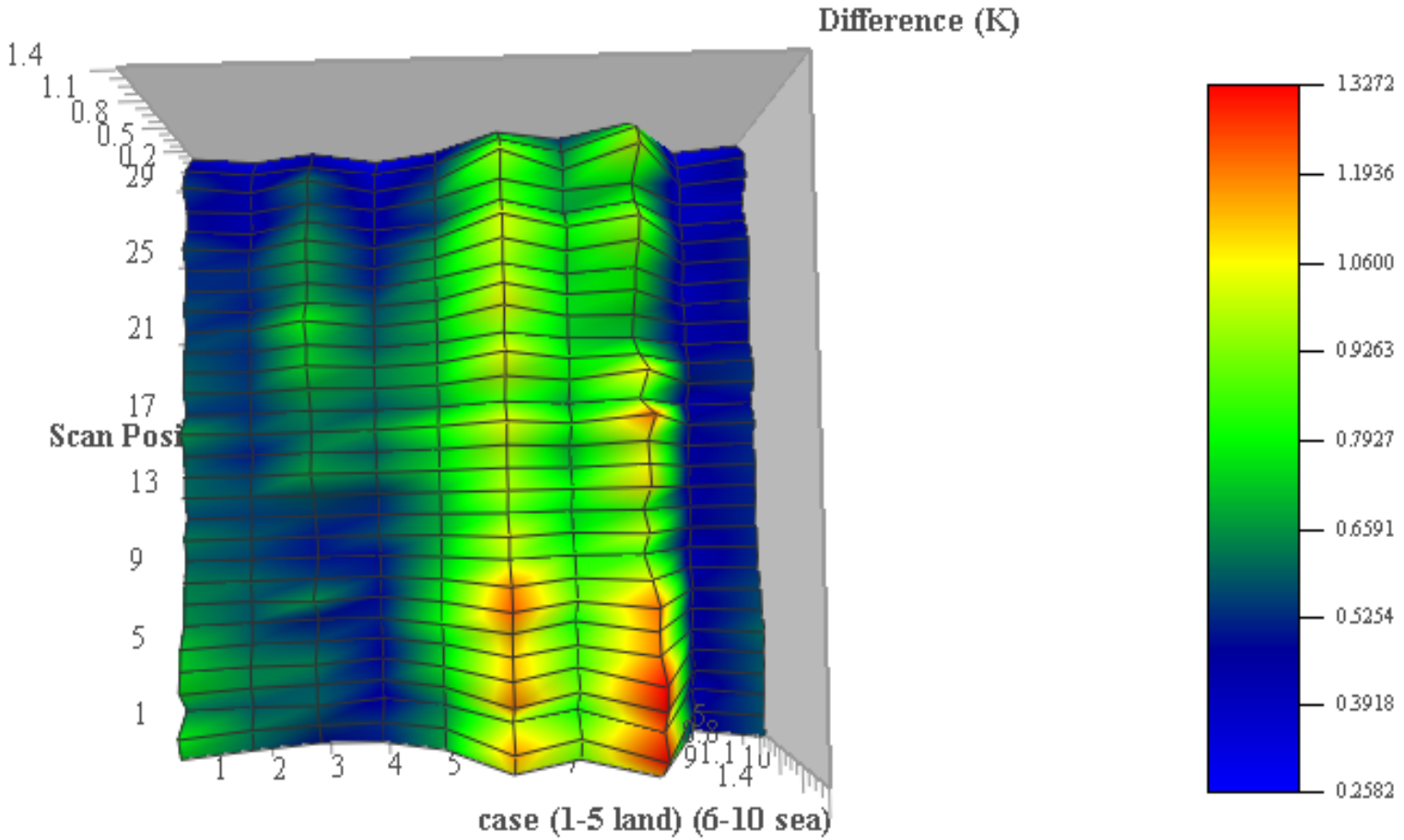
Channel 10 bias only Residual Error (K)



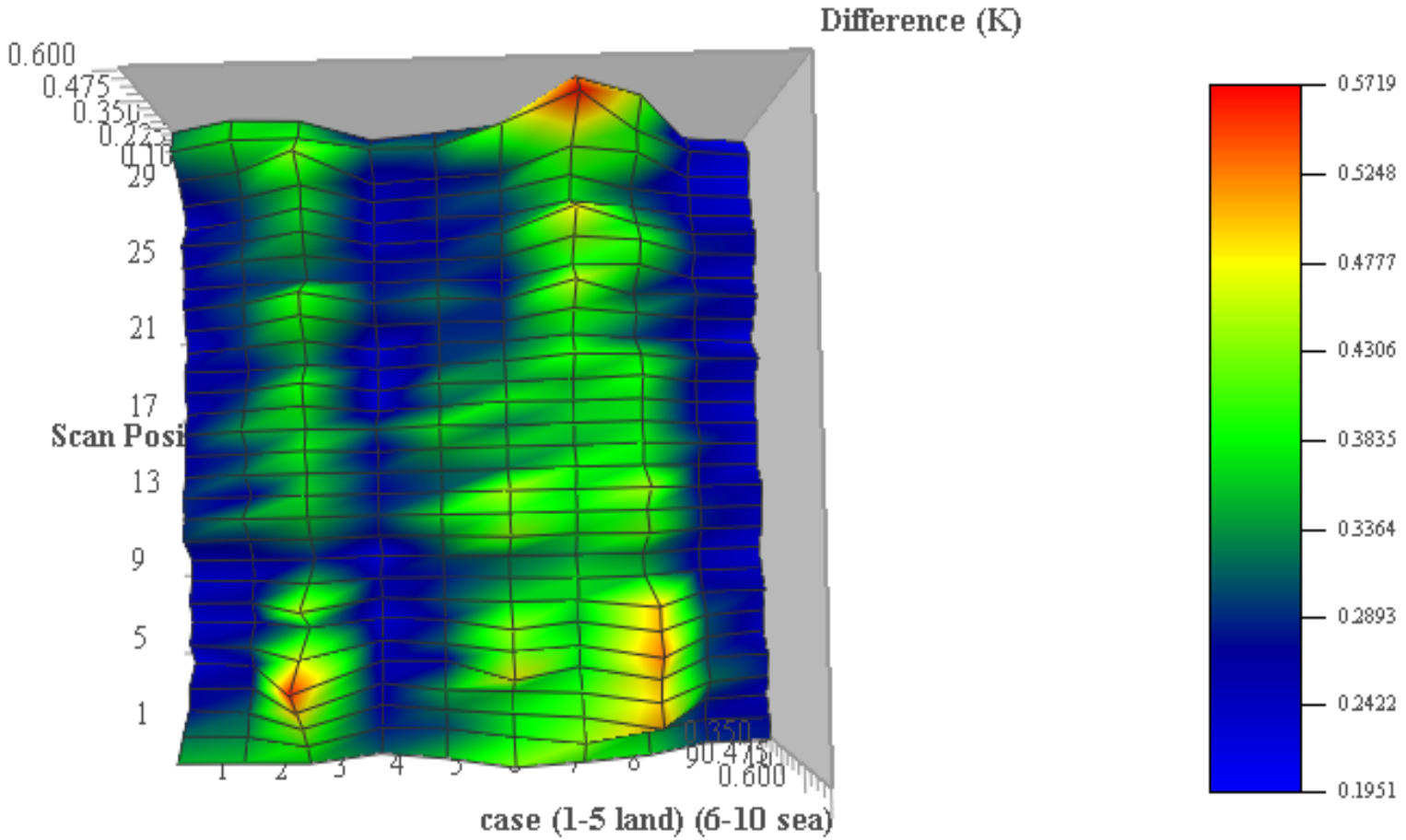
Channel 11 bias only Residual Error (K)



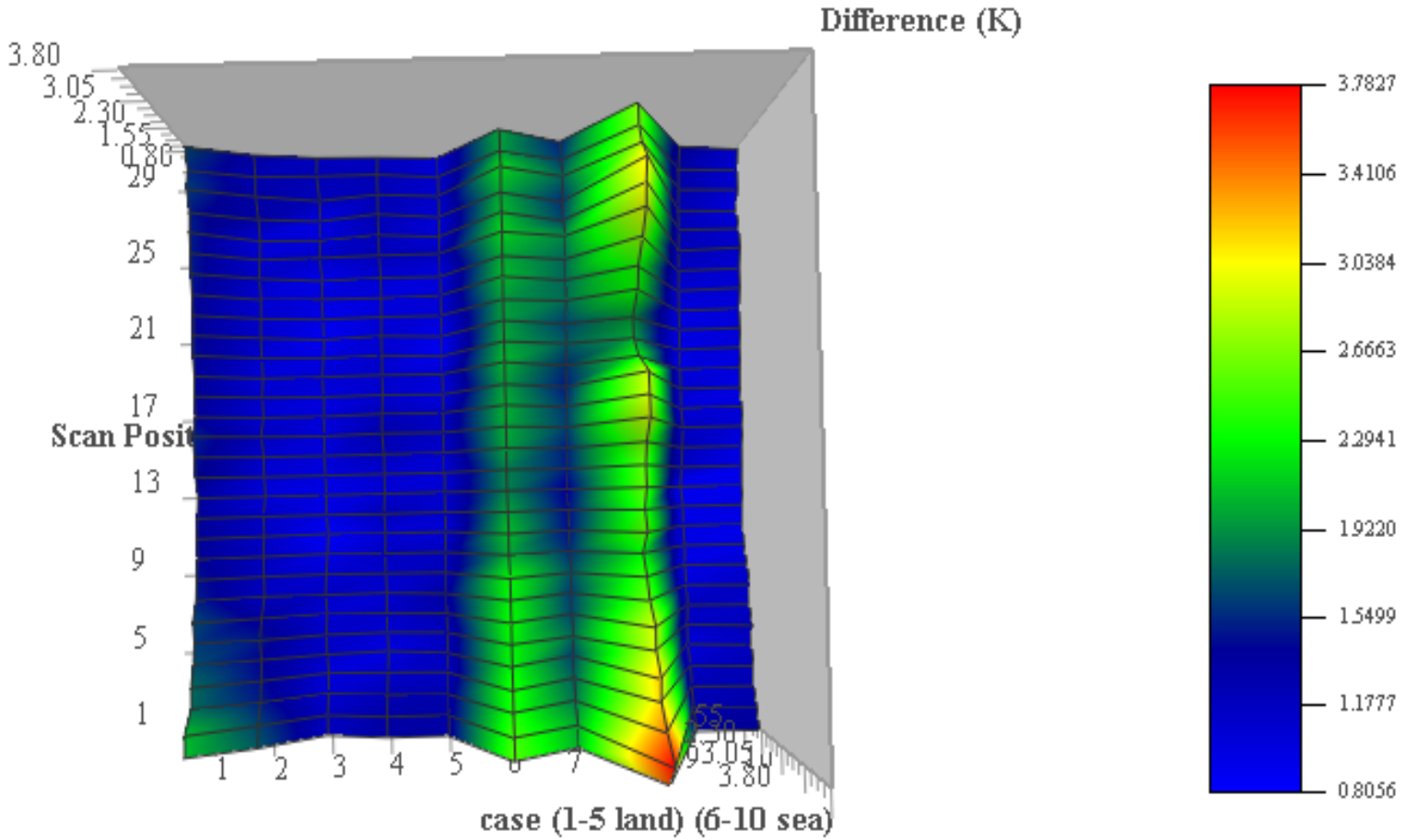
Channel 12 bias only Residual Error (K)



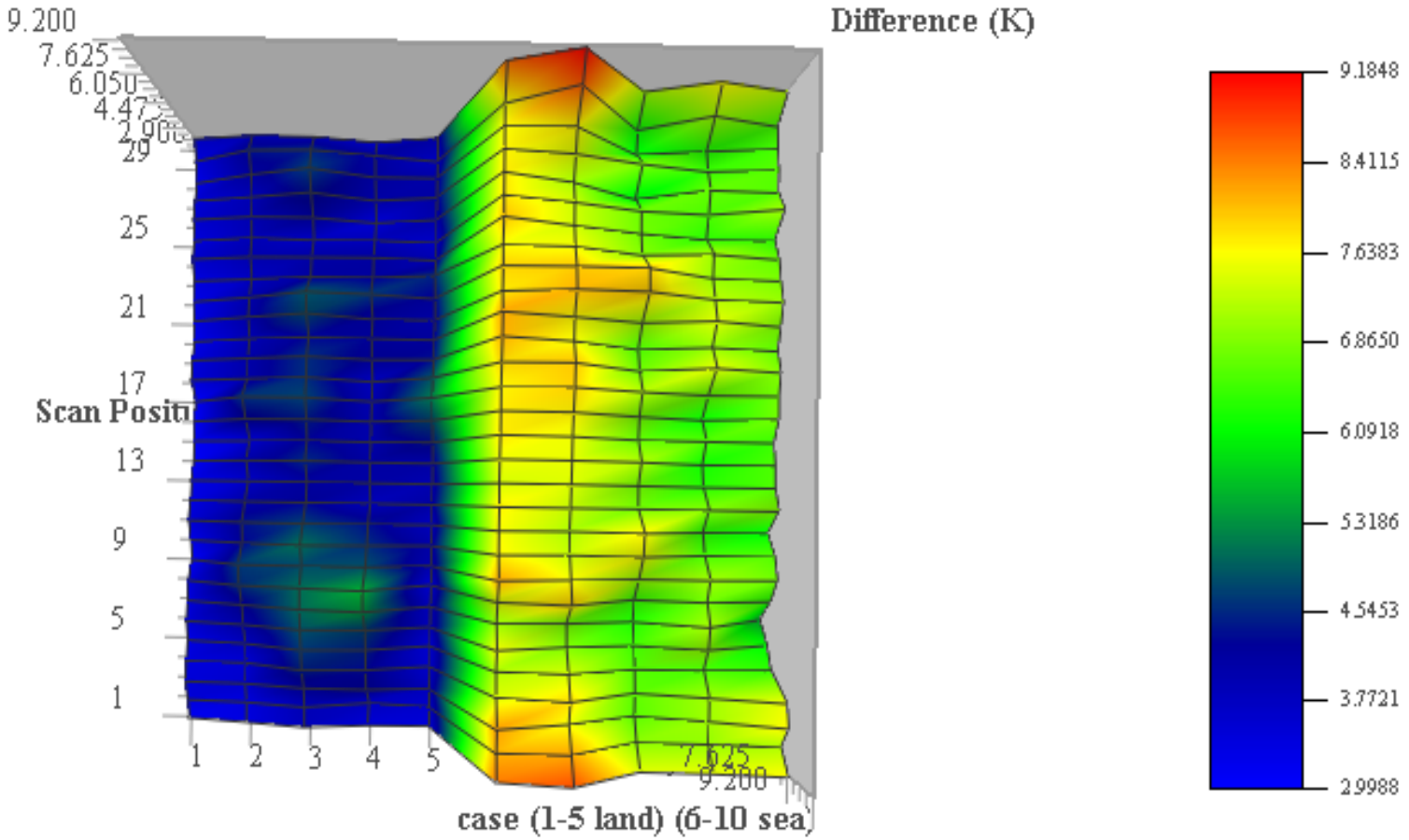
Channel 13 bias only Residual Error (K)



Channel 14 bias only Residual Error (K)



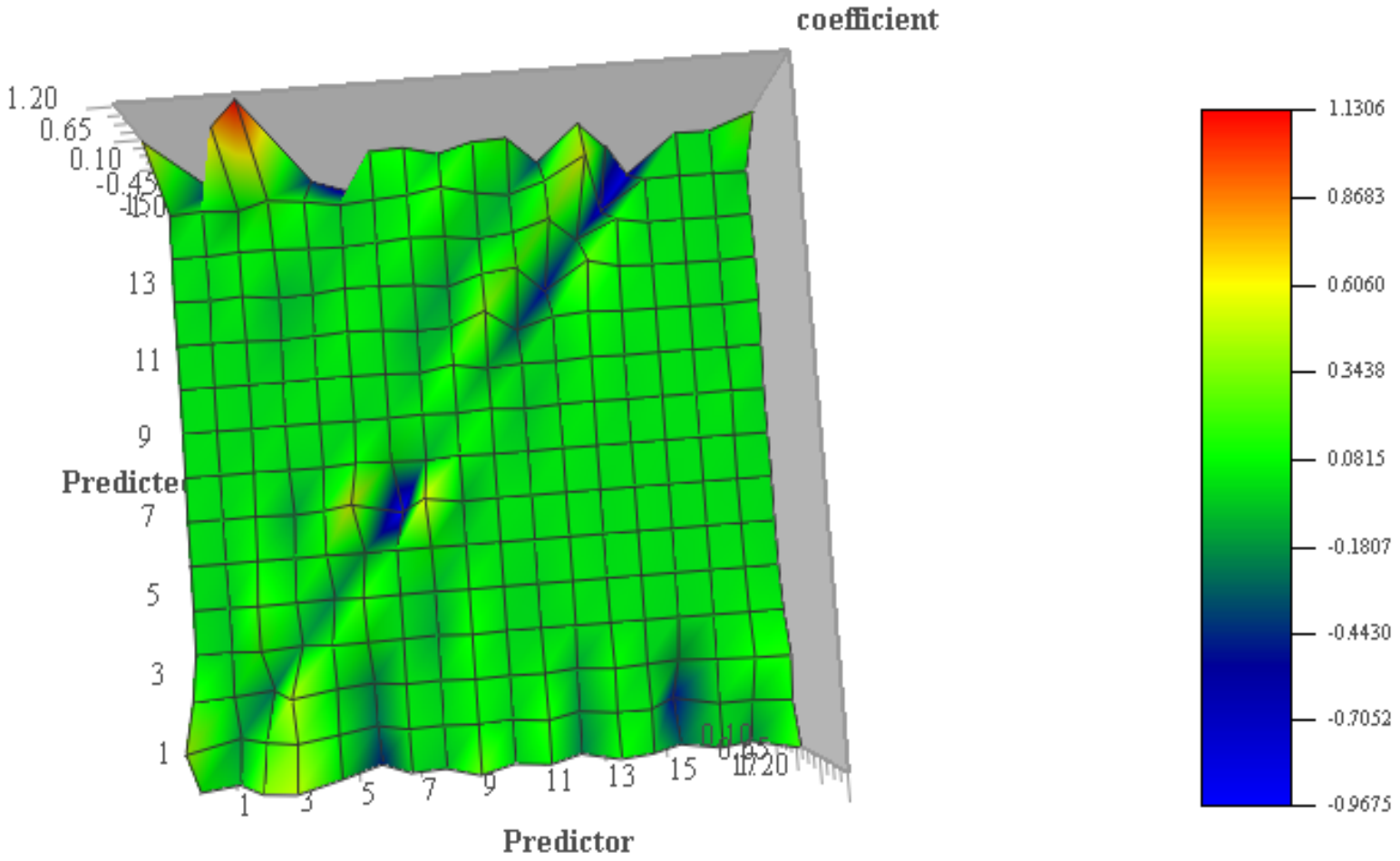
Channel 15 bias only Residual Error (K)



Regression coefficients

- The next slide shows the regression coefficients
- Note the strong diagonal dominance
- Part of this is a noise reducing pattern where the channel and its neighbors come in with different signs and add to about 1.0
  - This implies that the nose is correlated - if uncorrelated, the signs would not be opposite

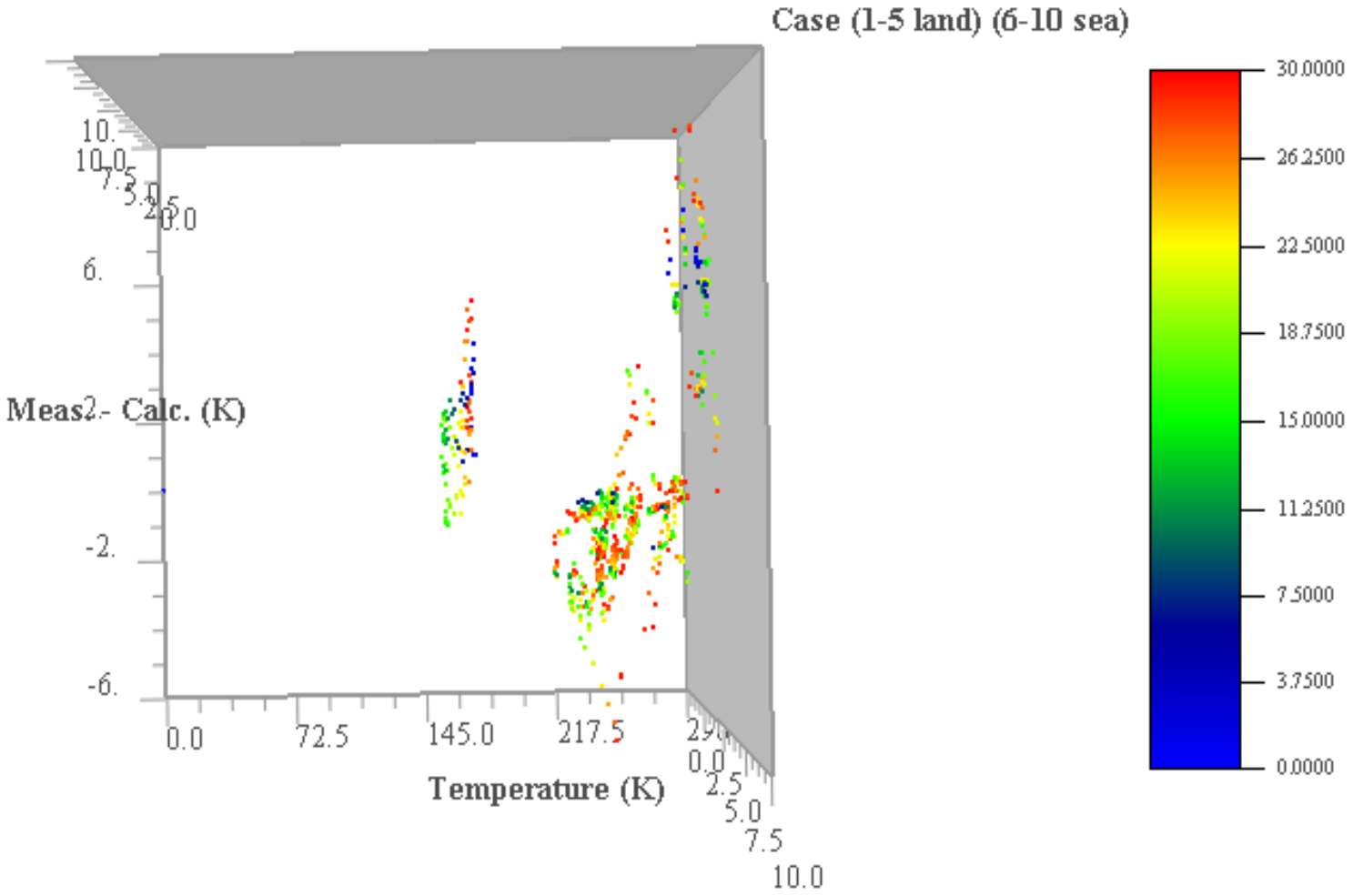
Regression coefficients for shrinkage regression



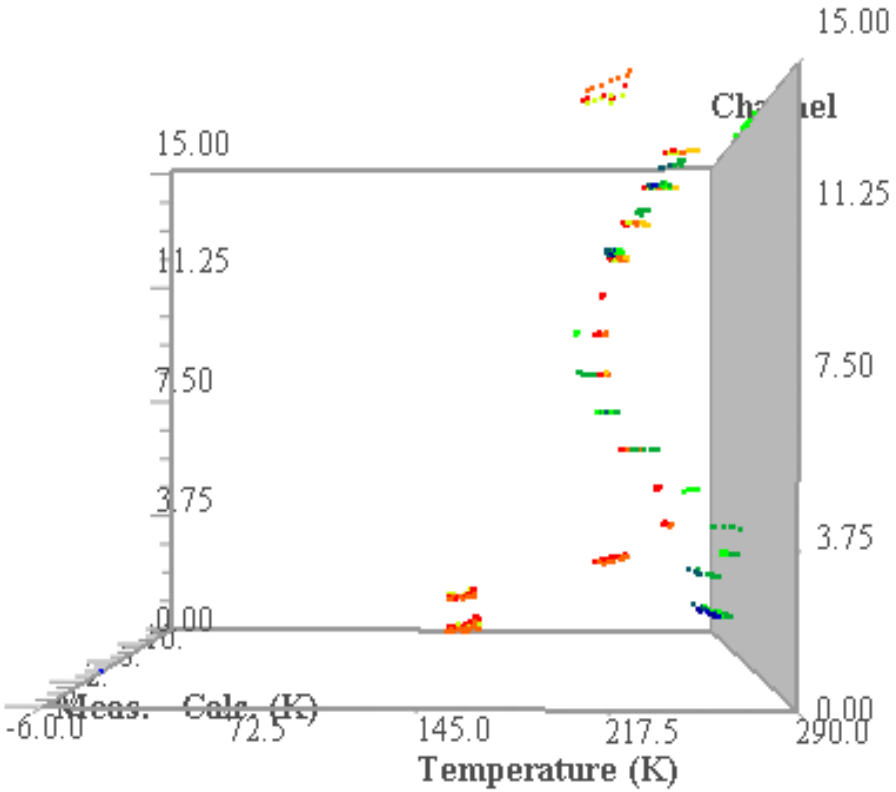
Slide Description

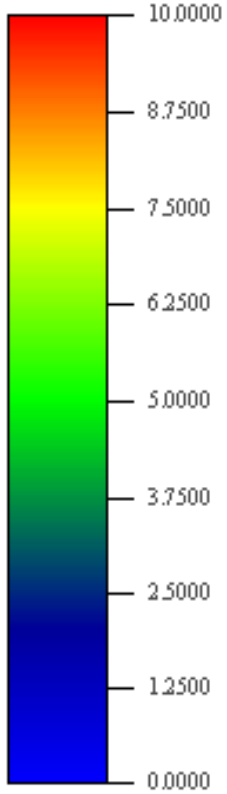
- The next 3 slides show the error patterns
- There seems to be a tendency for the error to be correlated with the channel temperature.
  - Channel 1 over water is a noticeable exception

Bias as a function of Temperature (All channels and cases)
The isolated cluster on the left is channel 1 over sea

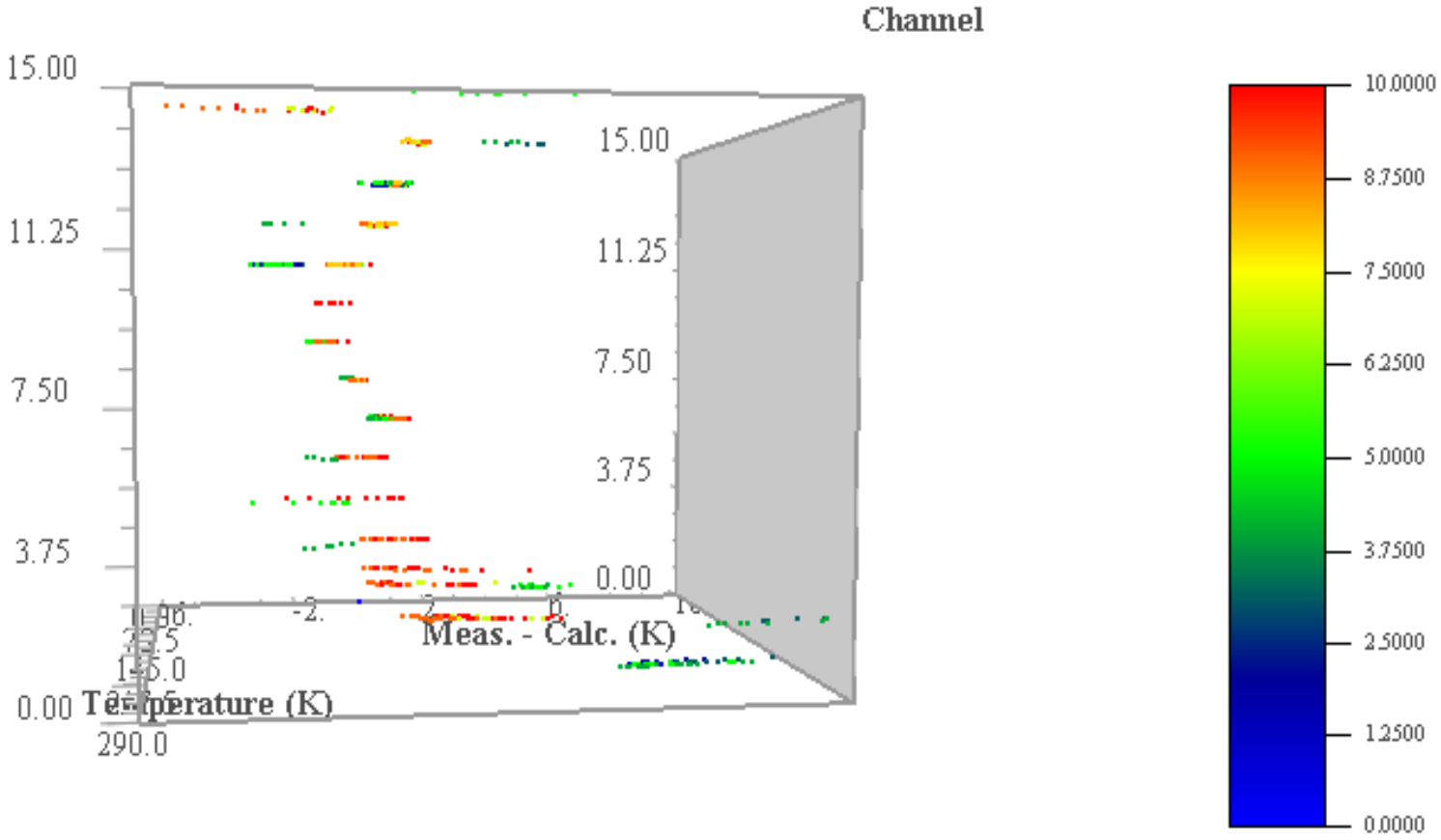


Temperature as a Function of Channel





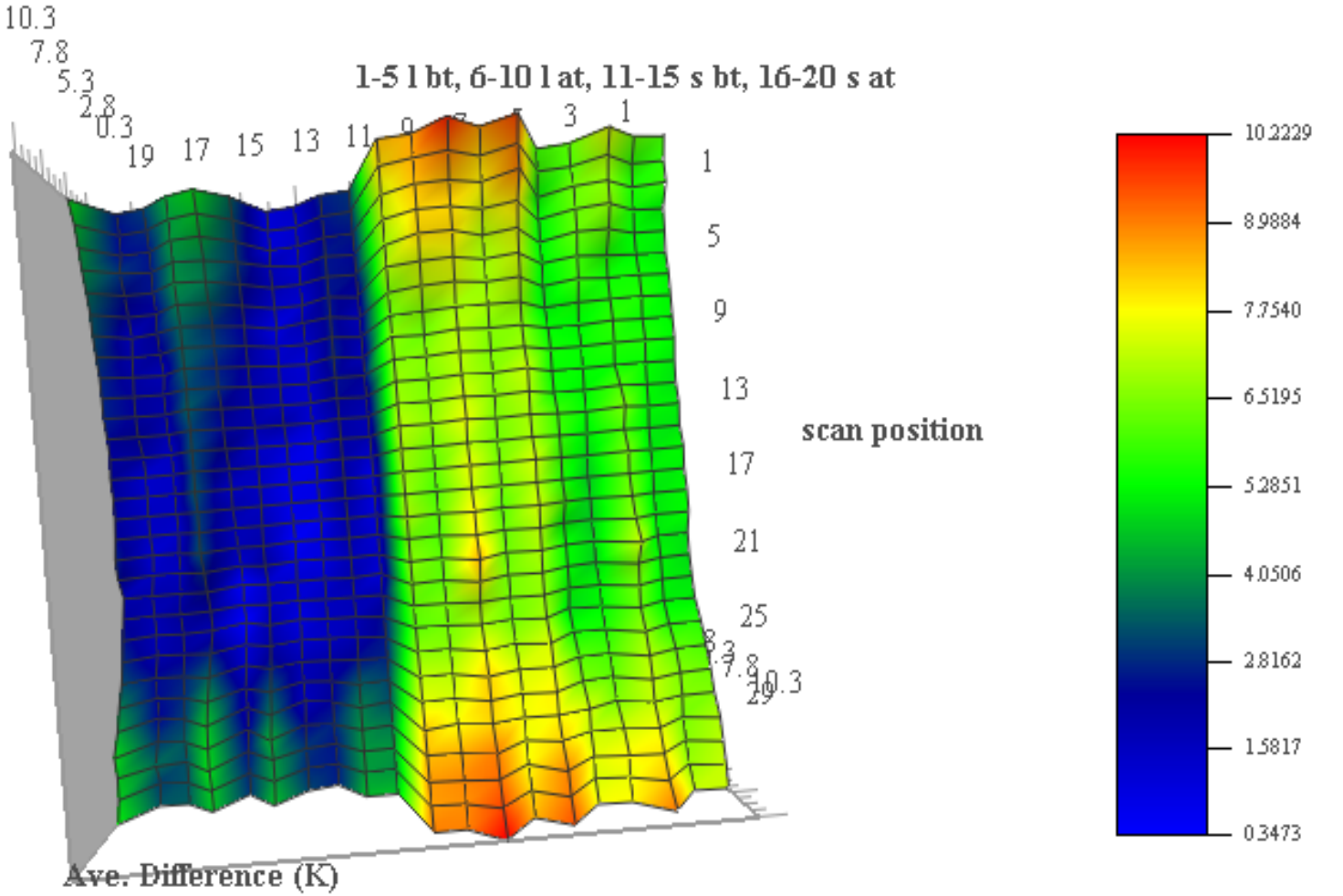
Bias as a Function of Channel



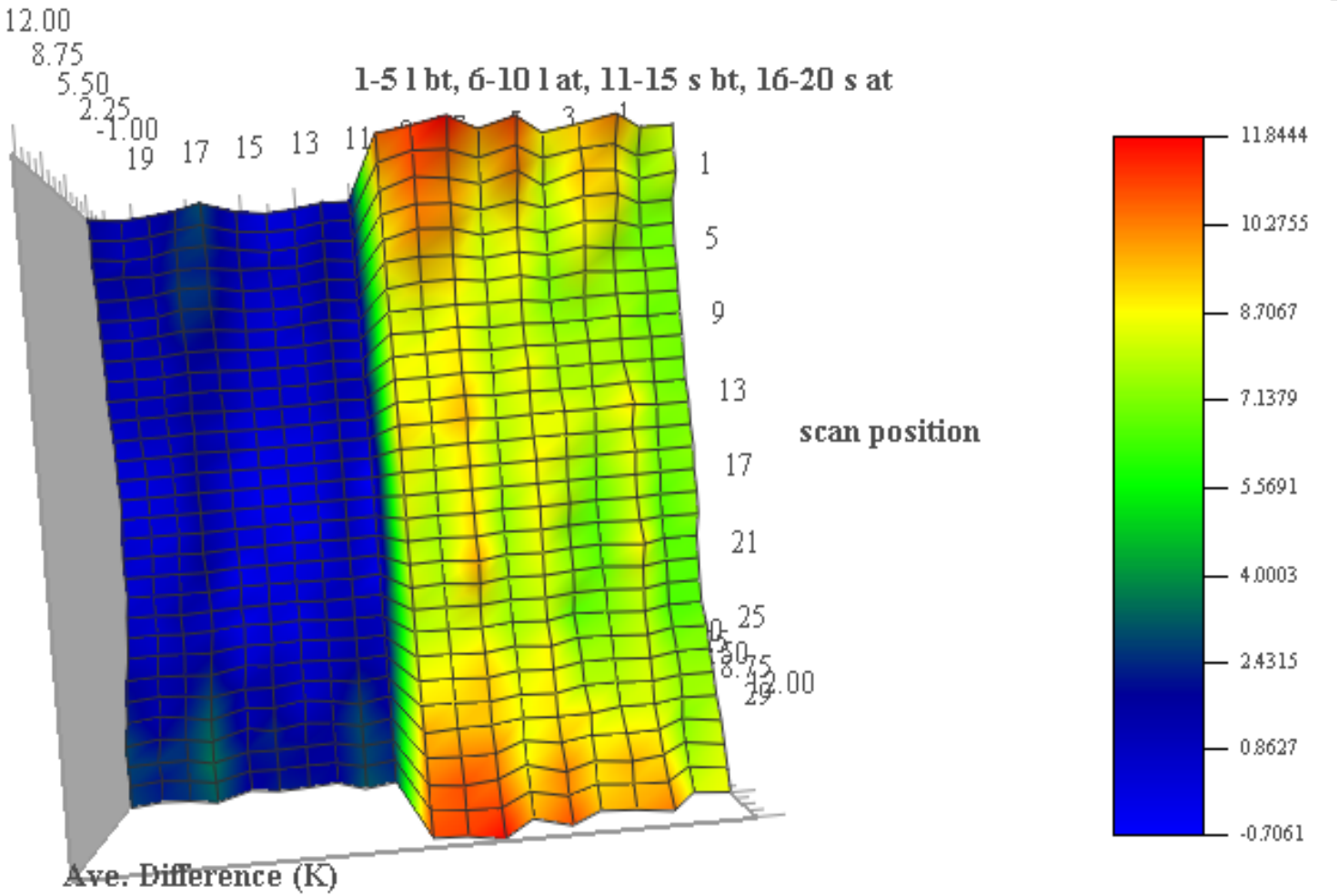
Adjustment Evaluation

- The next 15 slides show the bias with and without the adjustment
  - Bt is the brightness temperature with the JPL adjustments applied
    - 1-5 for land and 10 – 15 for sea
  - At is the antennae temperature with no adjustments
    - 6-10 for land and 16 – 20 for sea

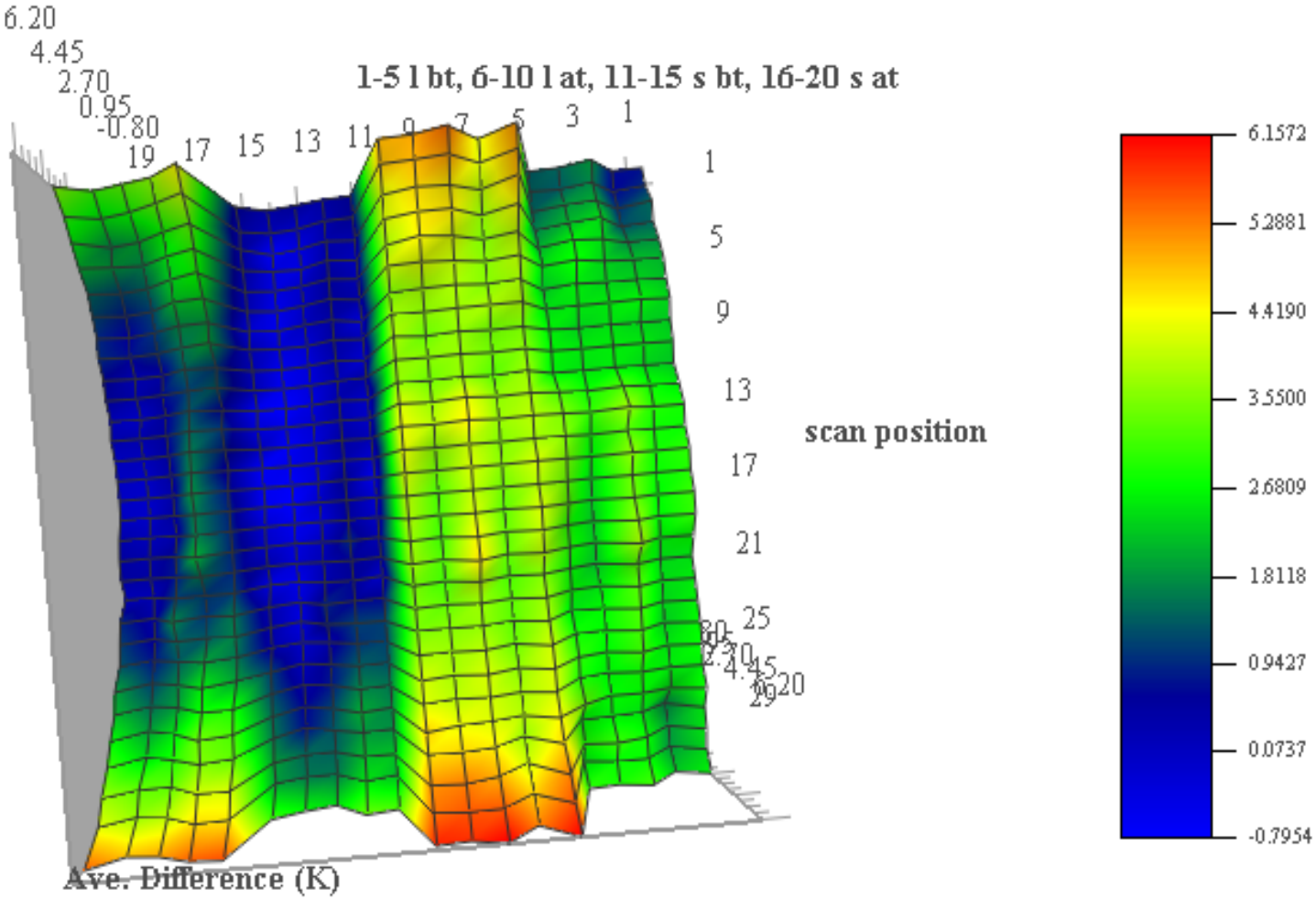
Channel 1 Difference



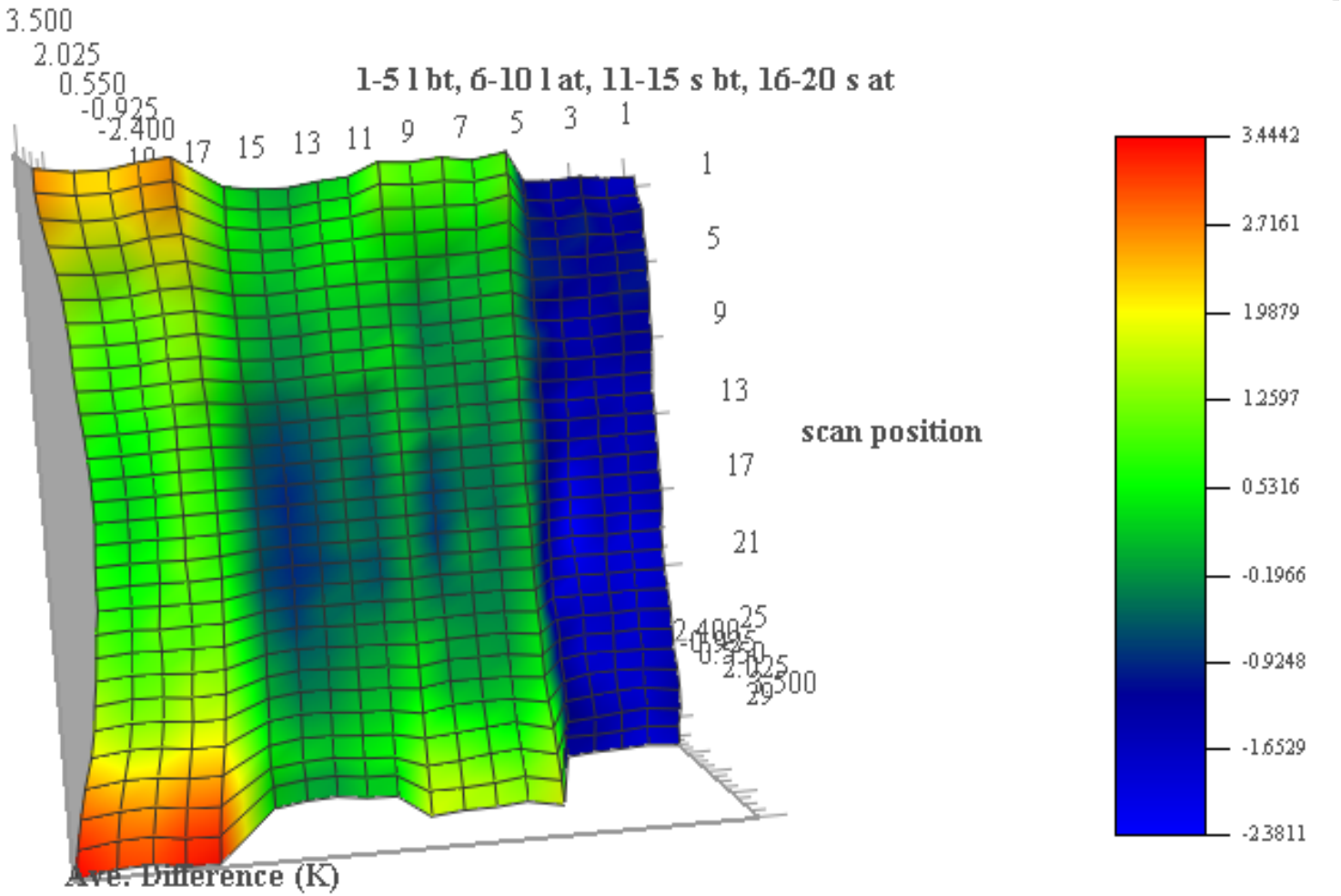
Channel 2 Difference



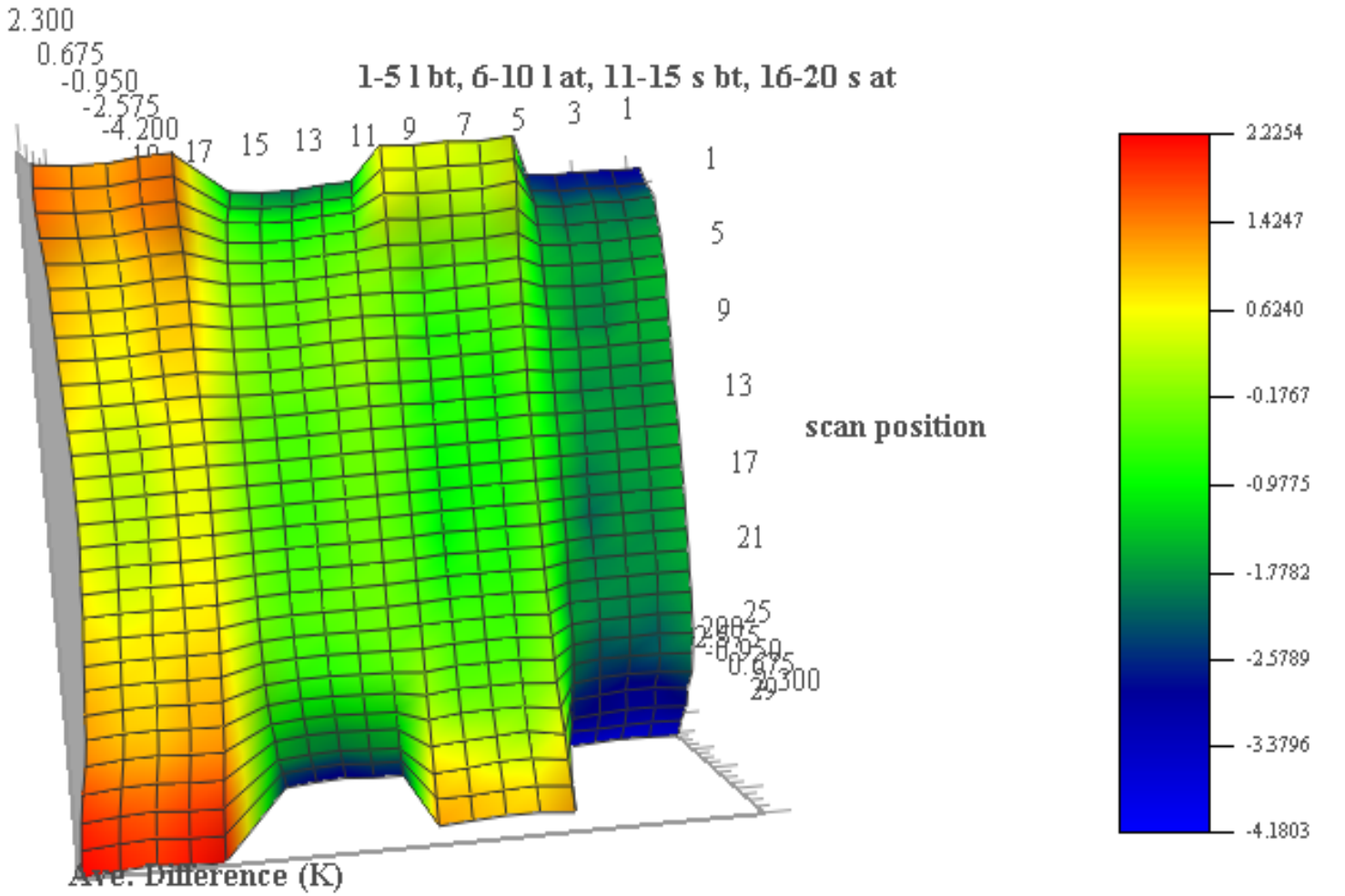
Channel 3 Difference



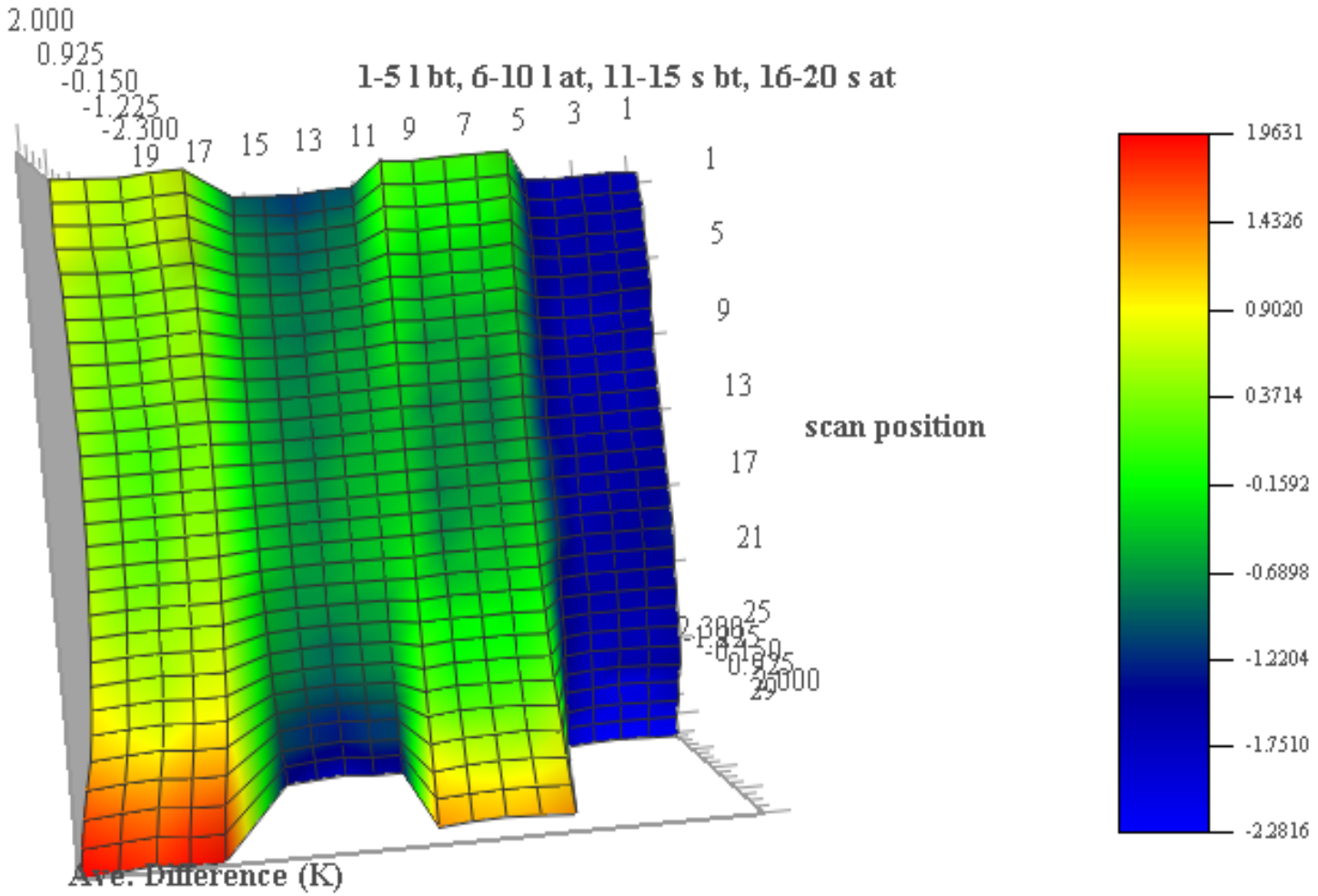
Channel 4 Difference



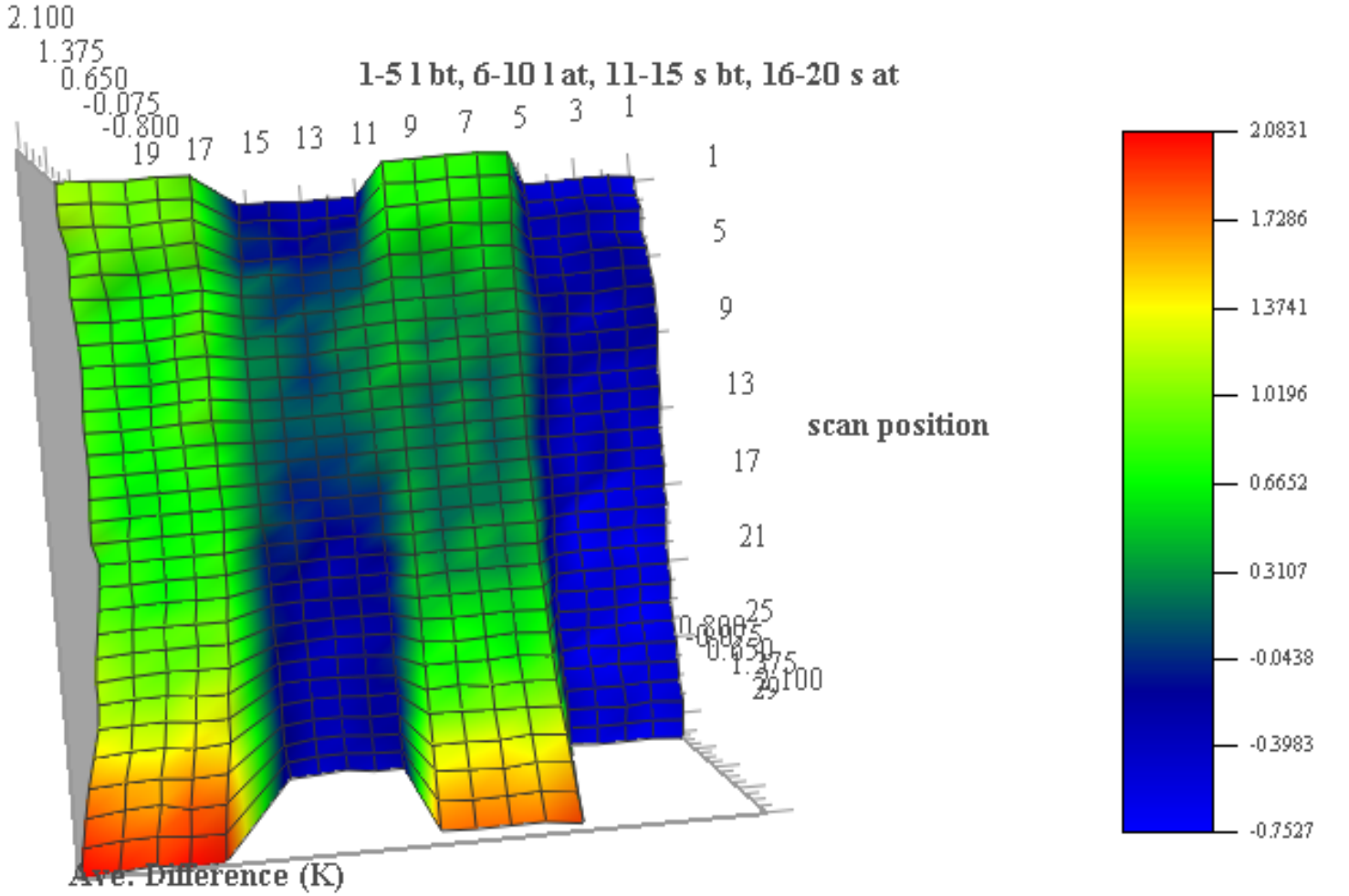
Channel 5 Difference



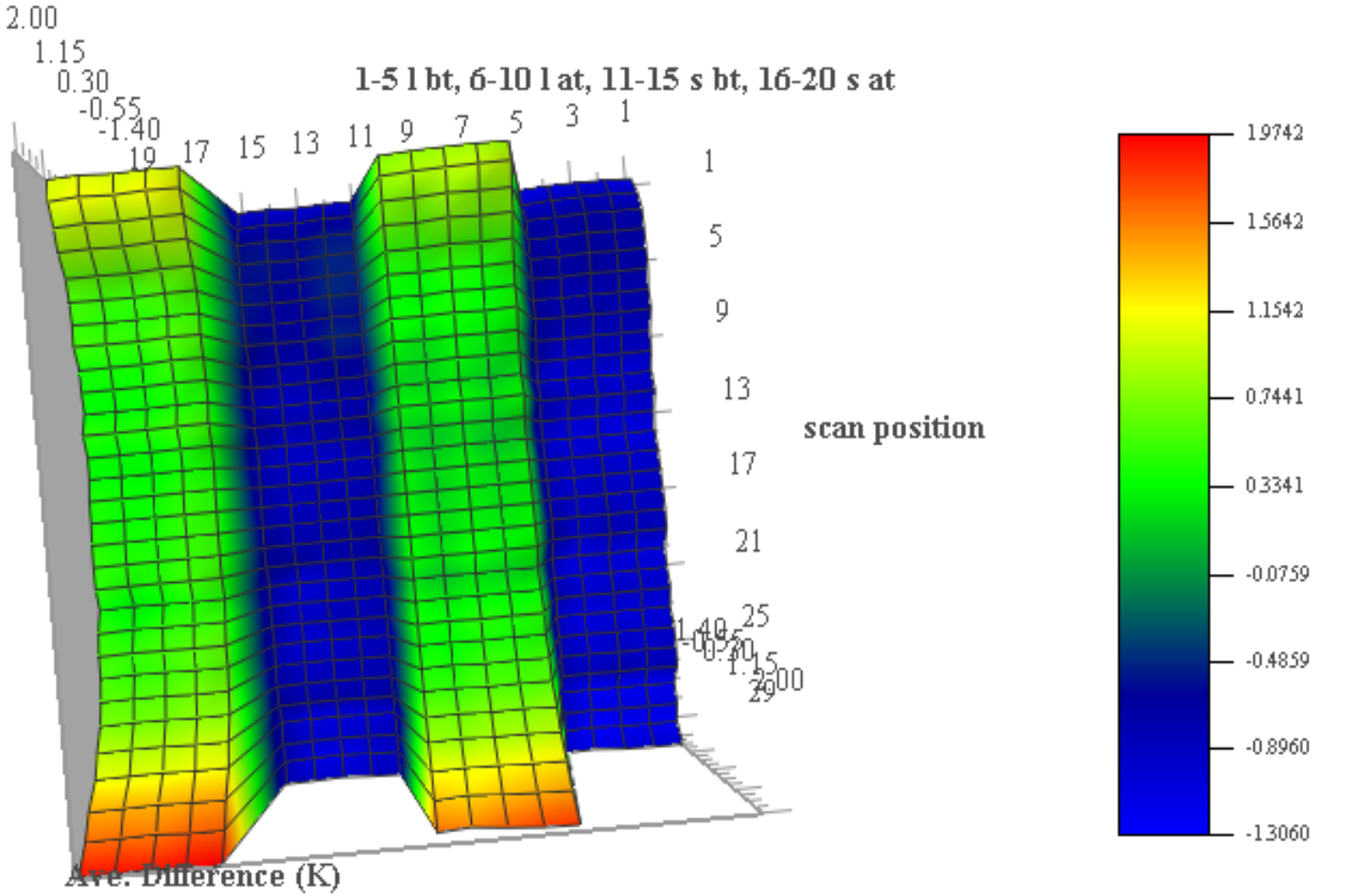
Channel 6 Difference



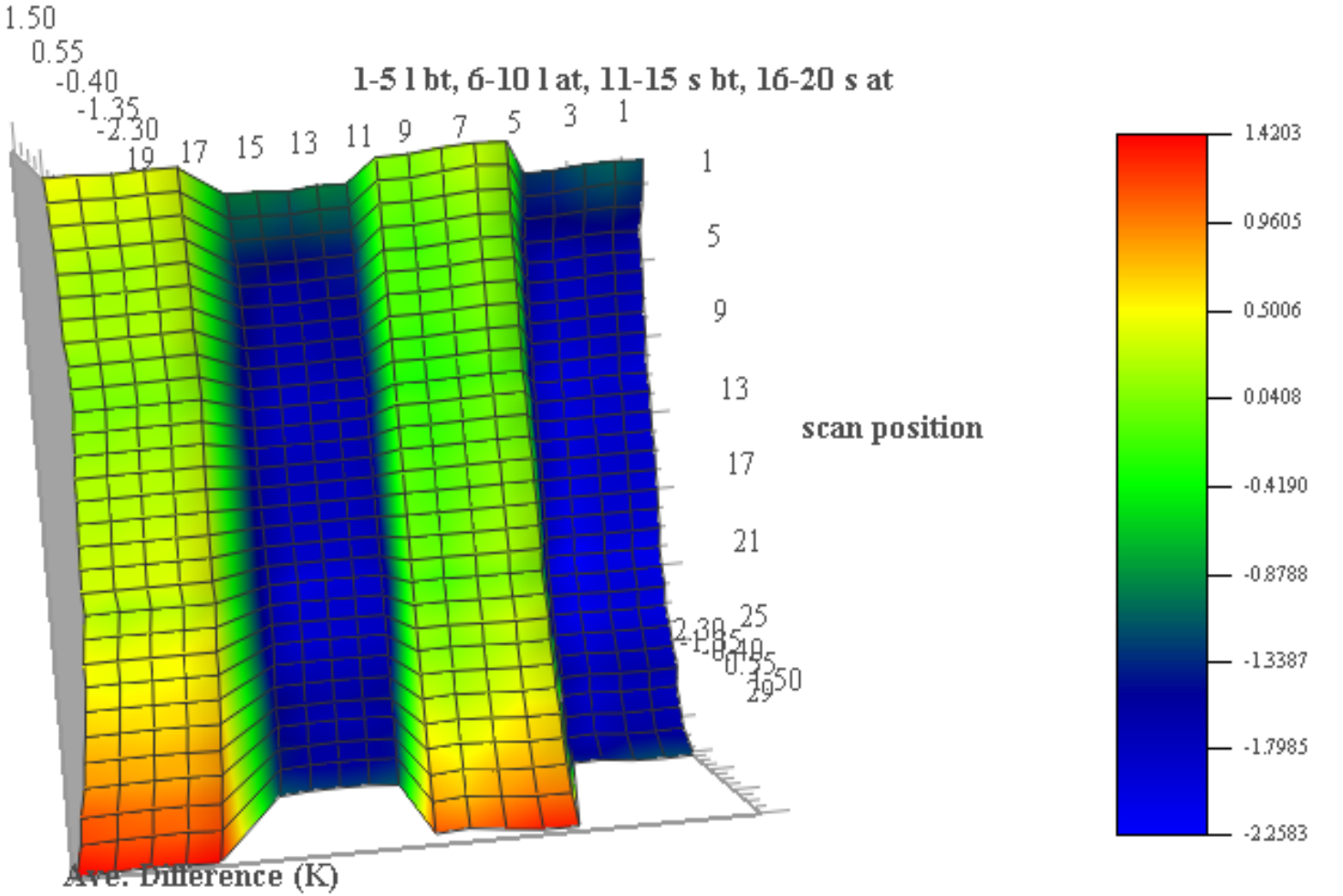
Channel 7 Difference



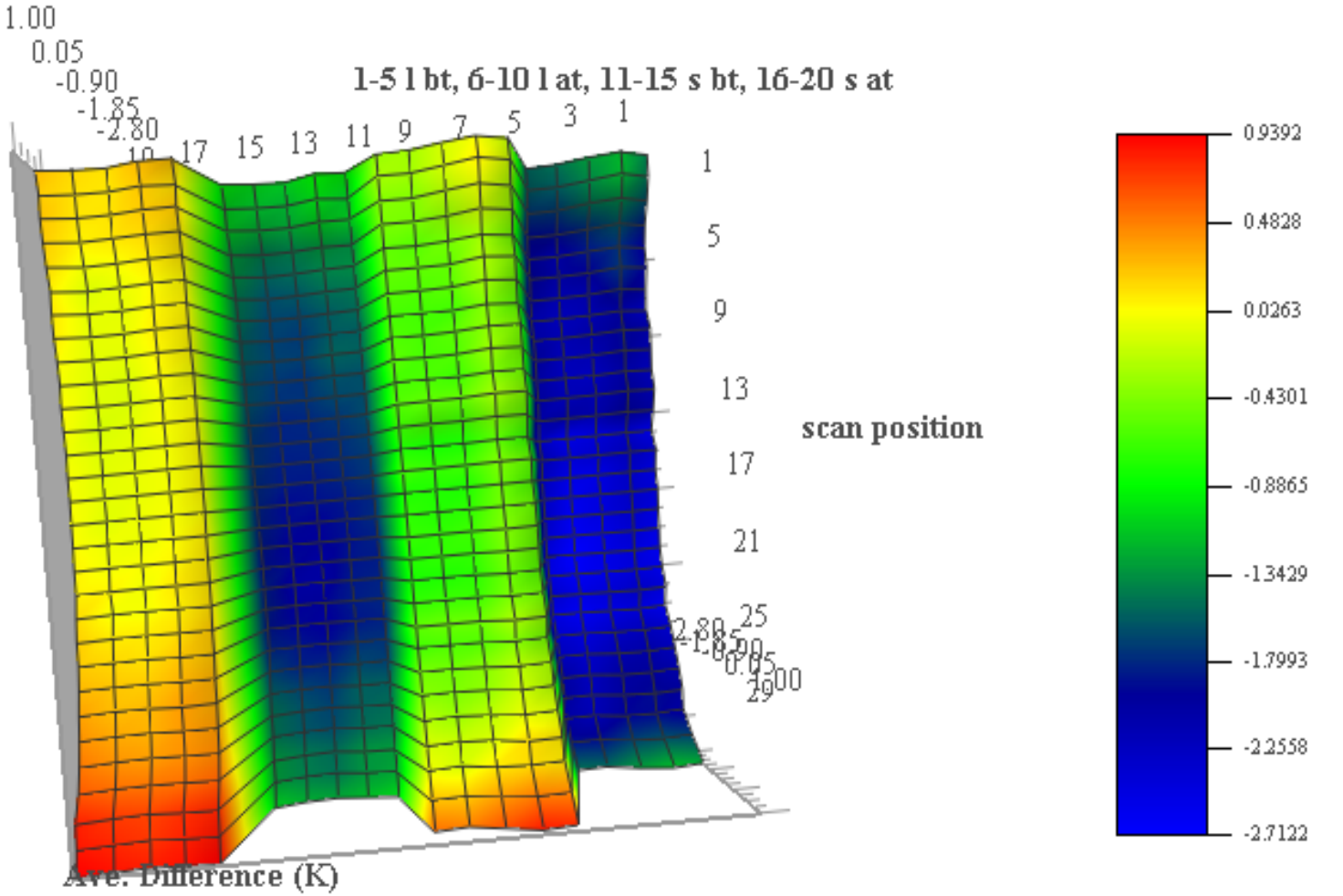
Channel 8 Difference



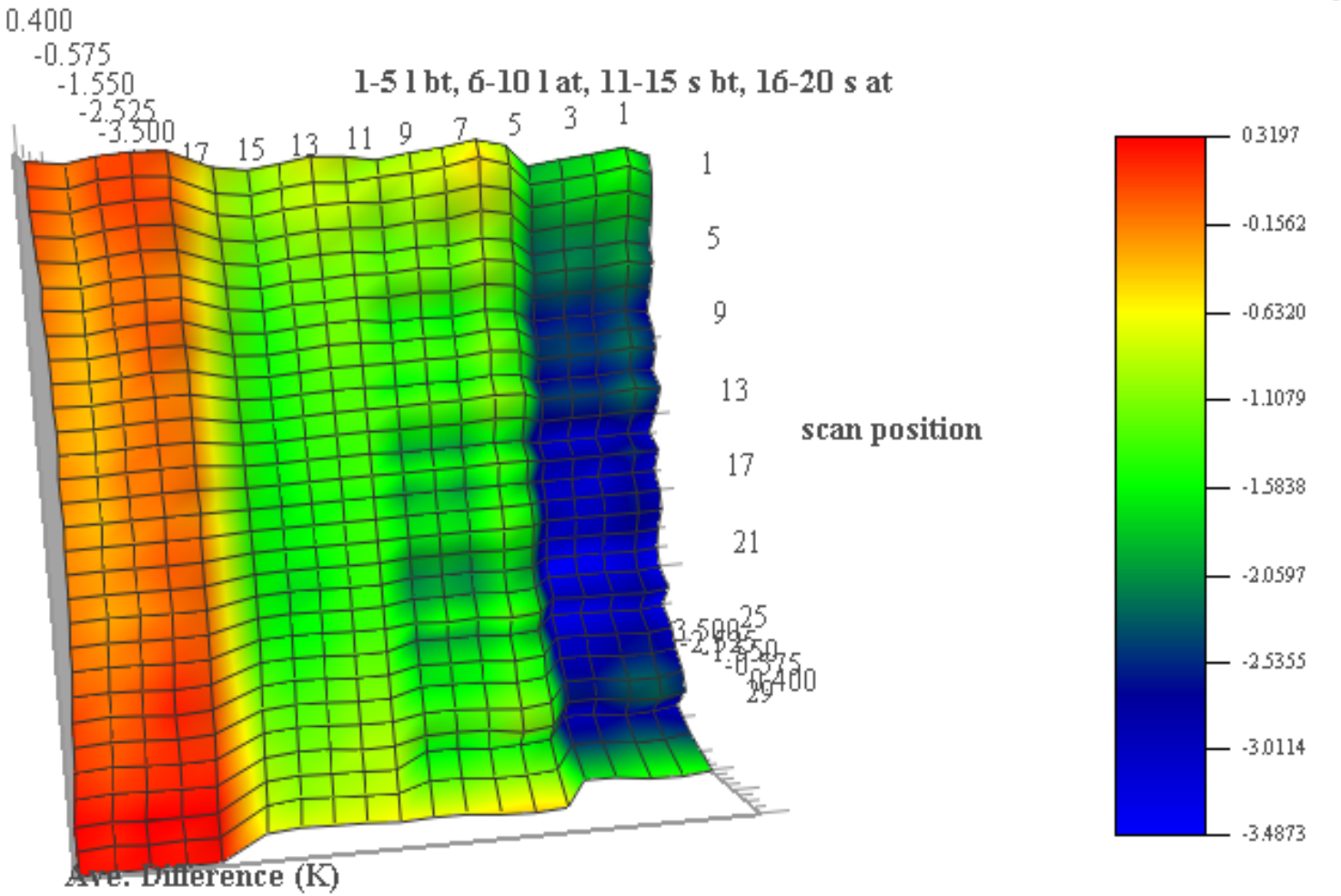
Channel 9 difference



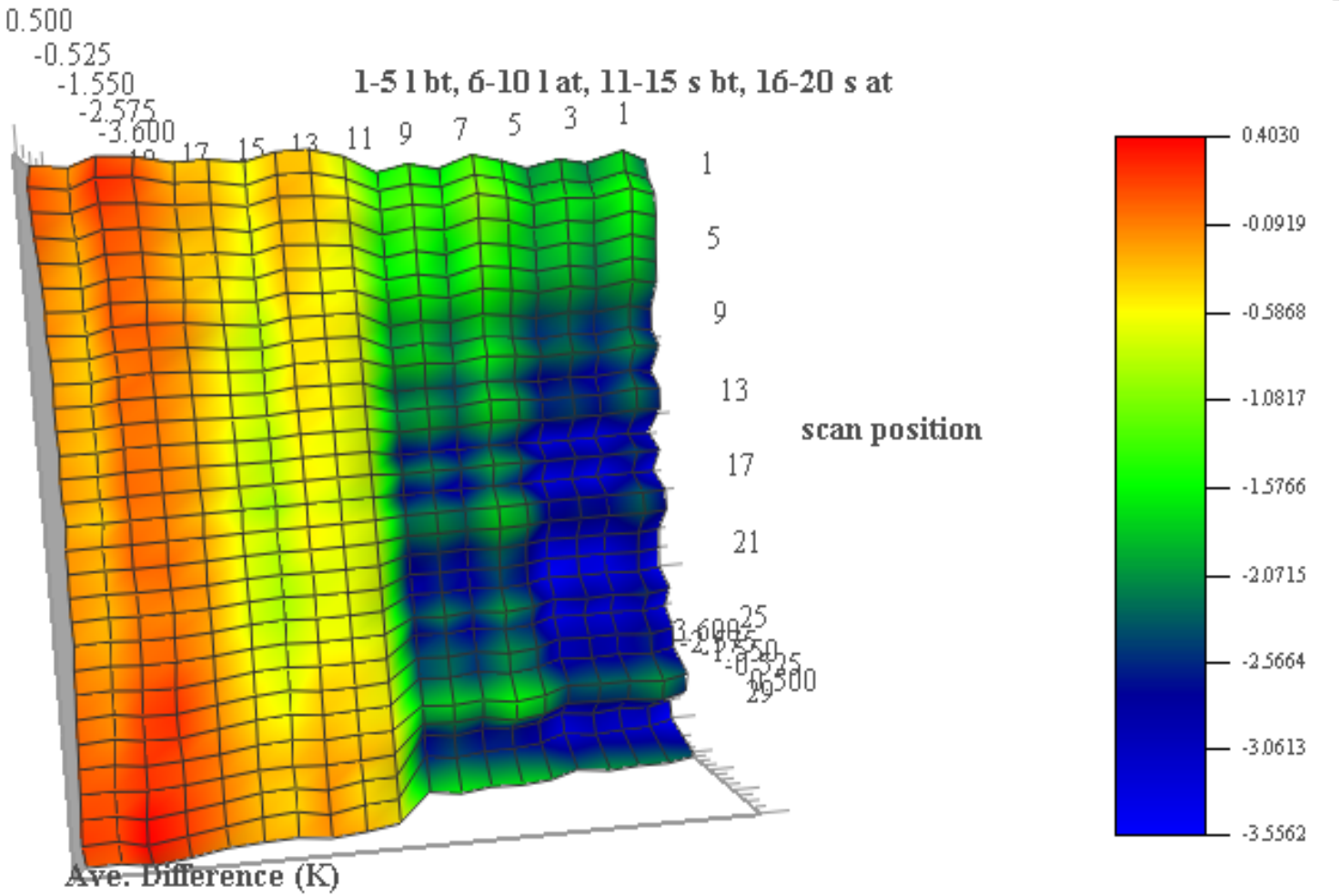
Channel 10 Difference



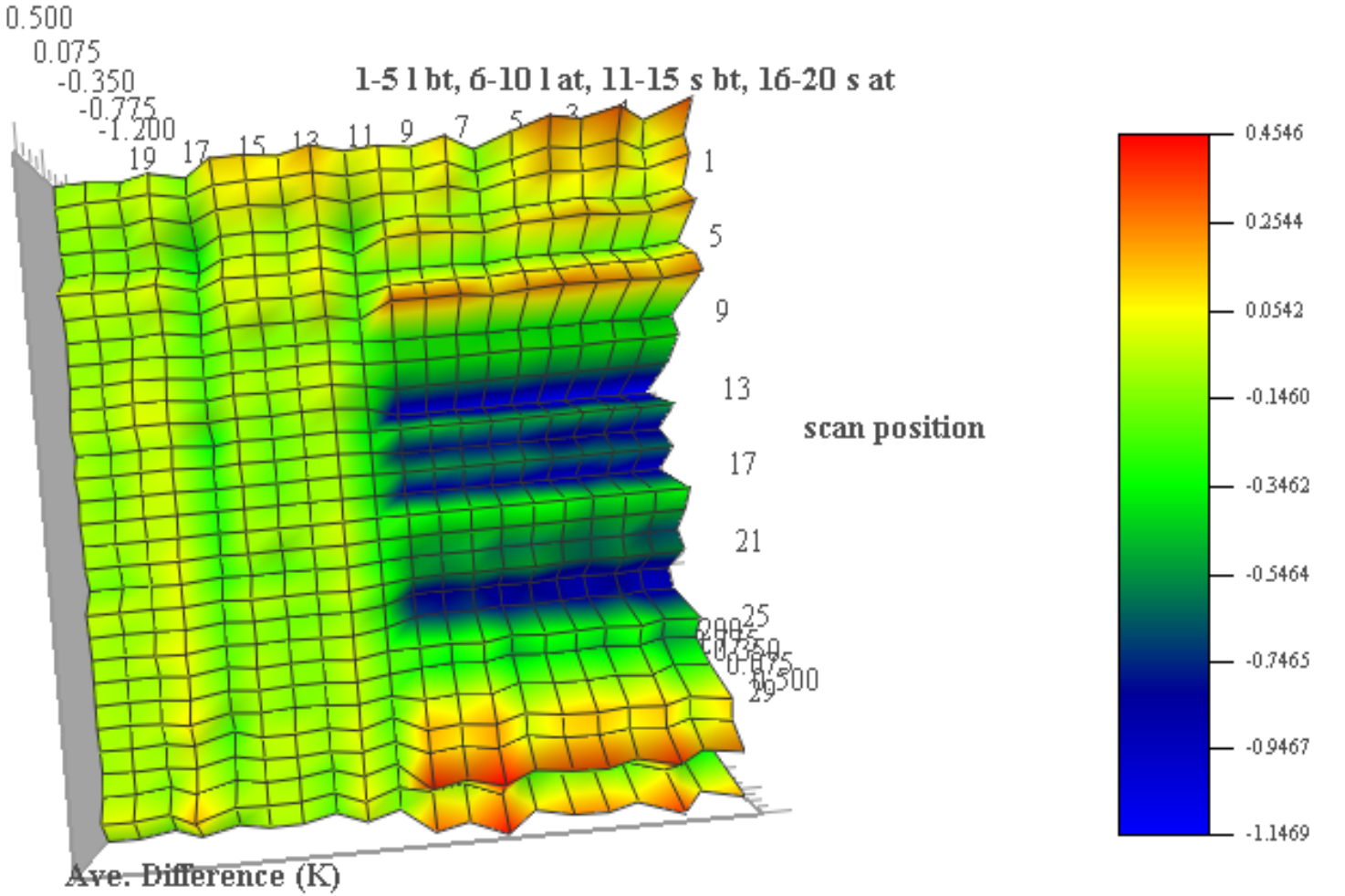
Channel 11 Difference



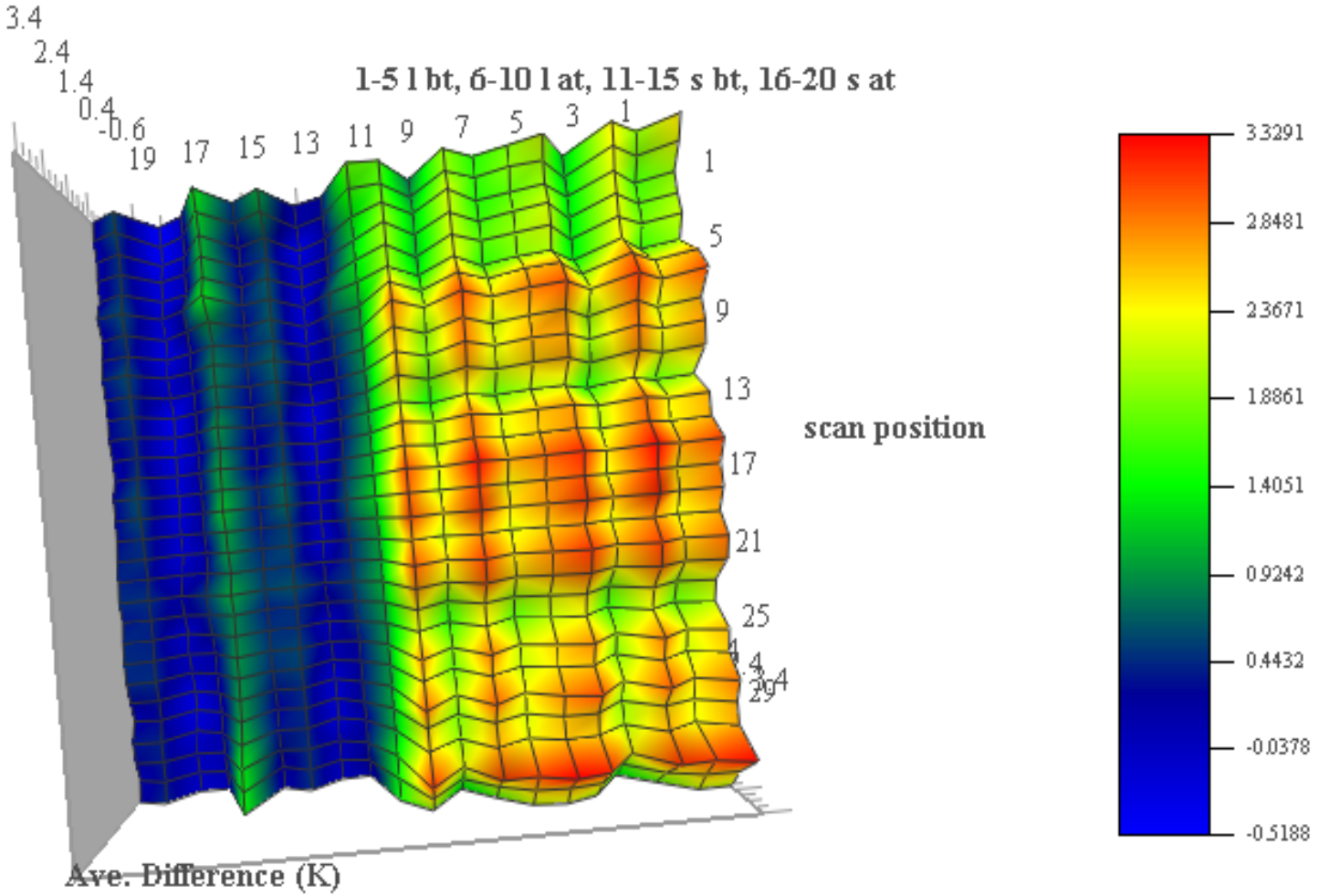
Channel 12 difference



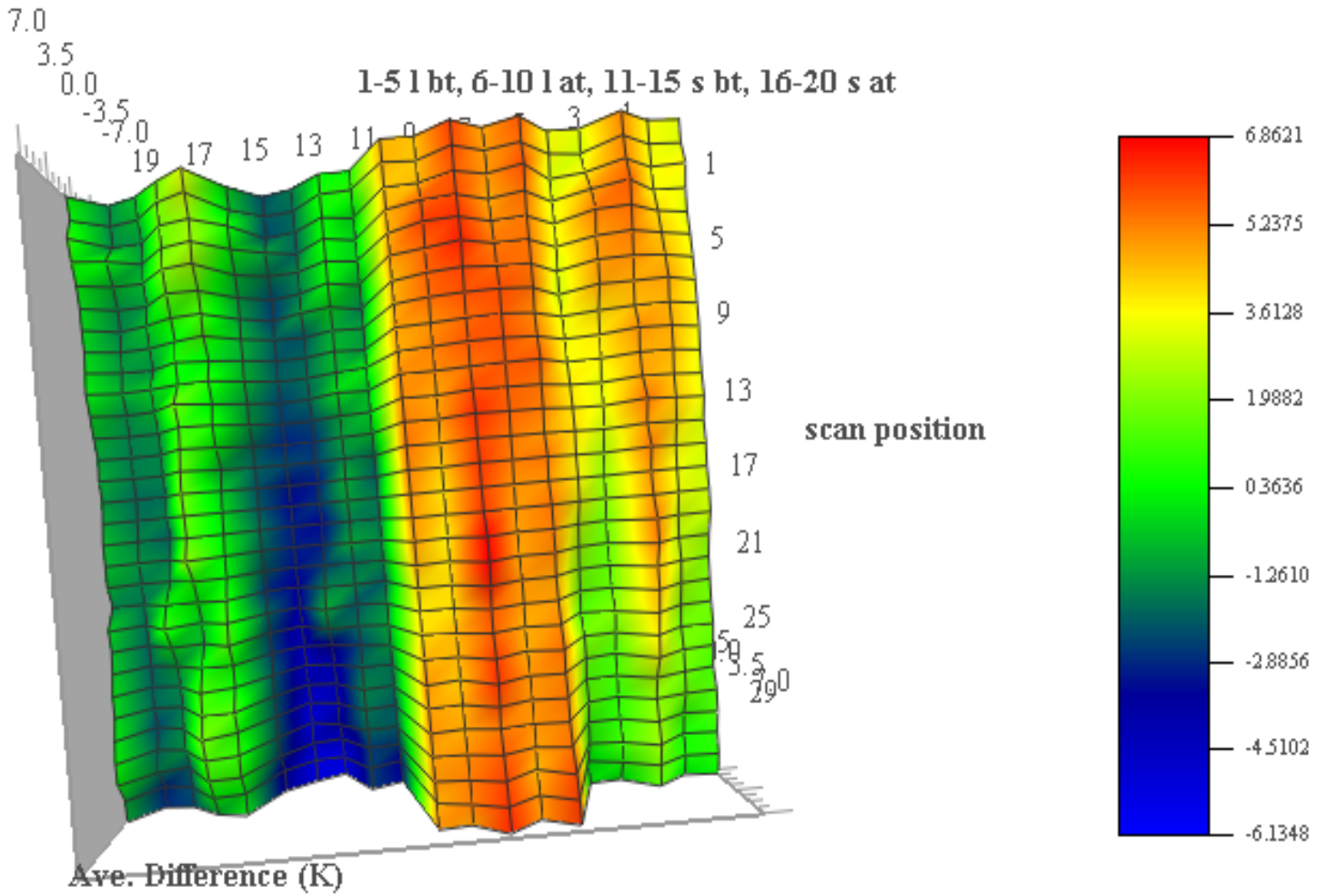
Channel 13 Difference



Channel 14 Difference



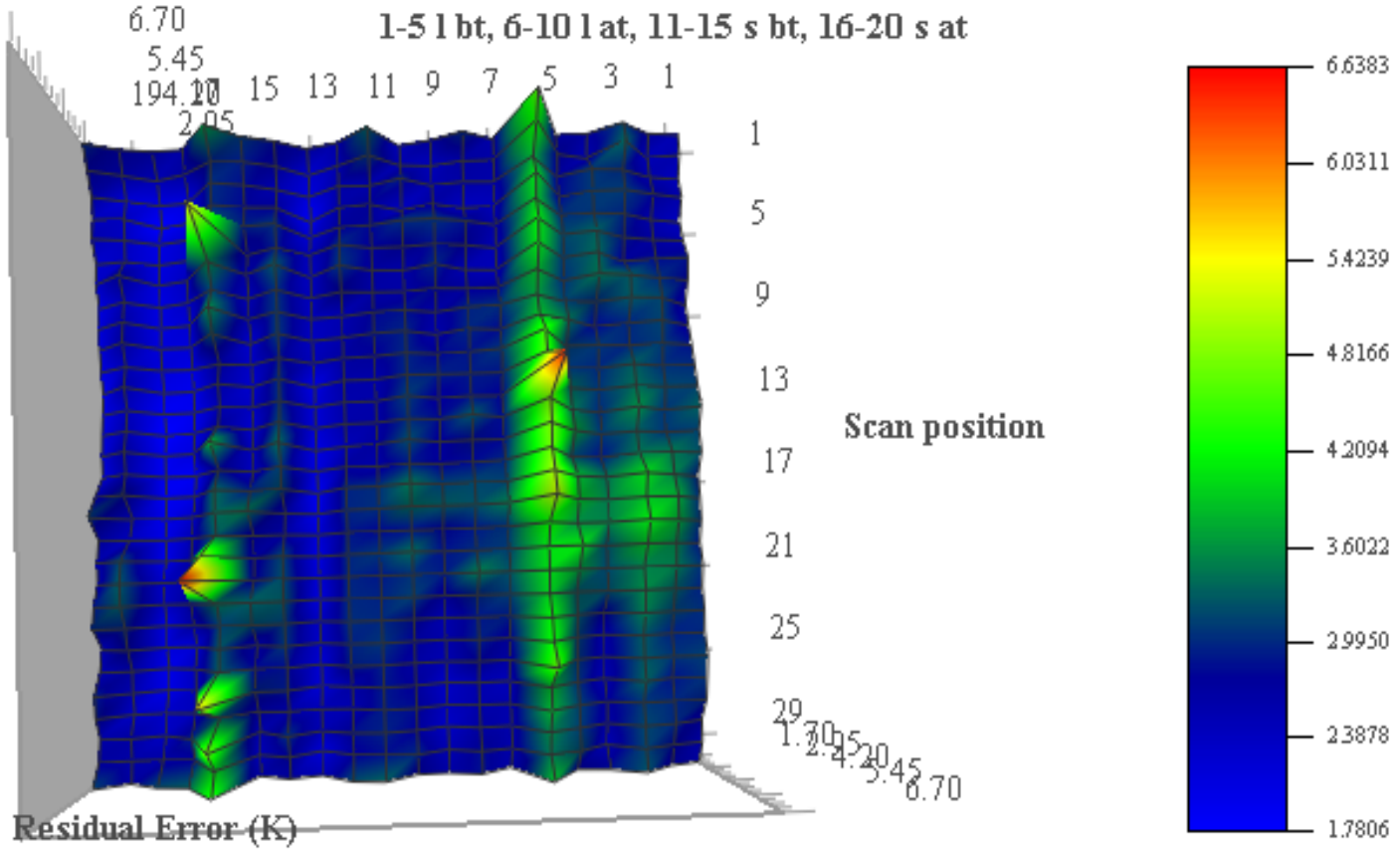
Channel 15 Difference



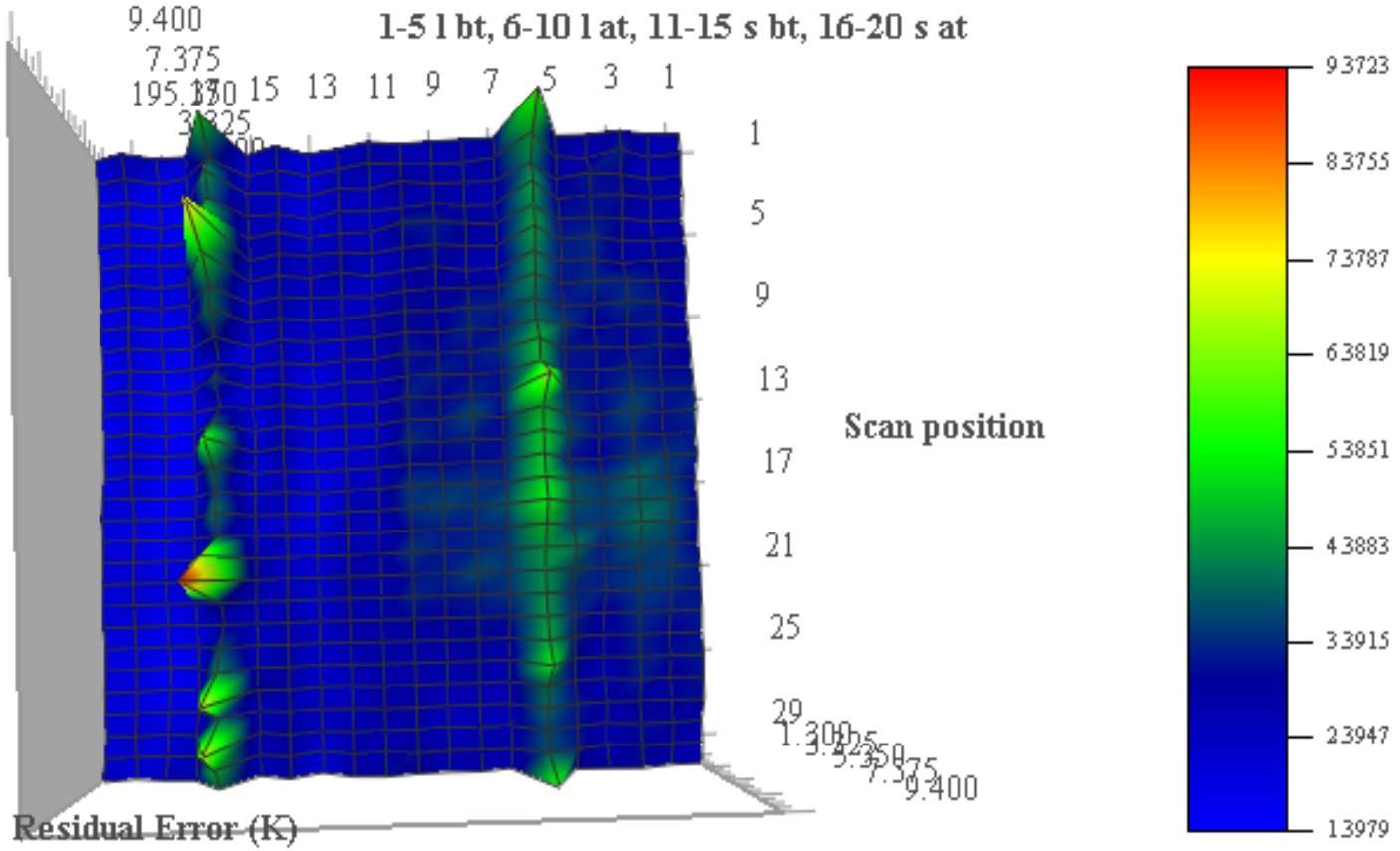
Adjustment Evaluation

- The next 15 slides show the residual errors after applying the bias correction with and without the JPL adjustment
  - Bt is the brightness temperature with the JPL adjustments applied
    - 1-5 for land and 10 – 15 for sea
  - At is the antennae temperature with no adjustments
    - 6-10 for land and 16 – 20 for sea

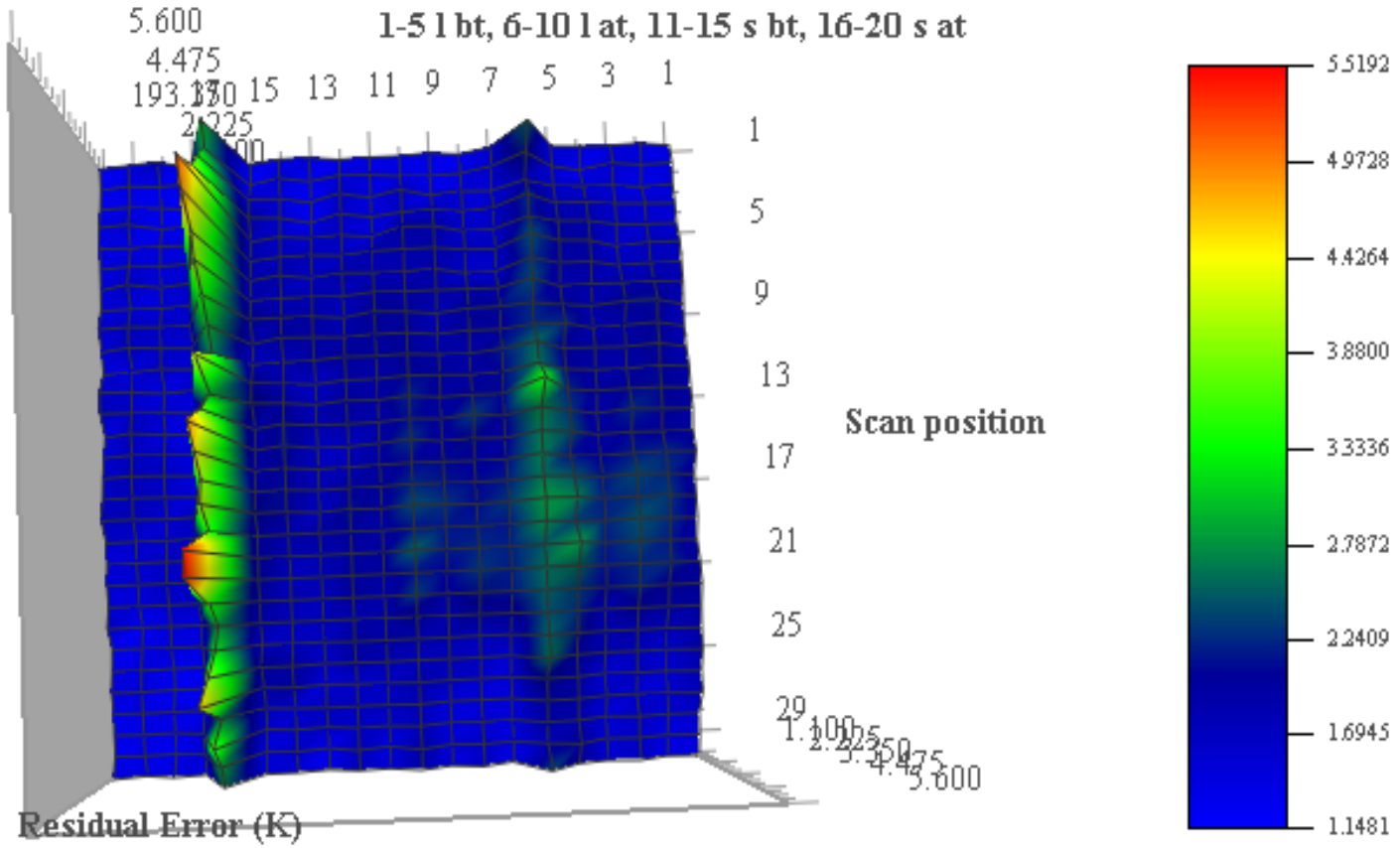
Channel 1 residuals



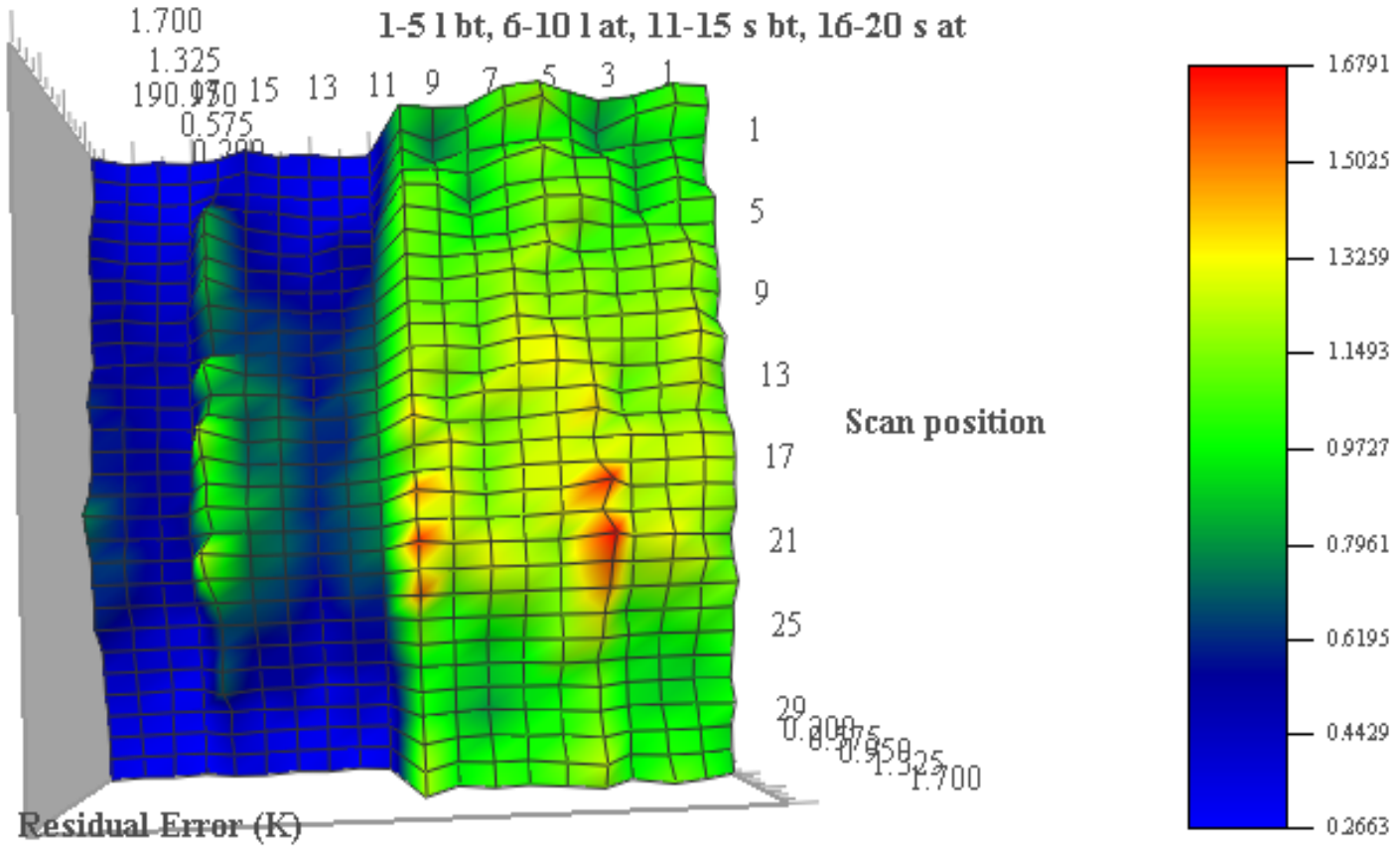
Channel 2 Residuals



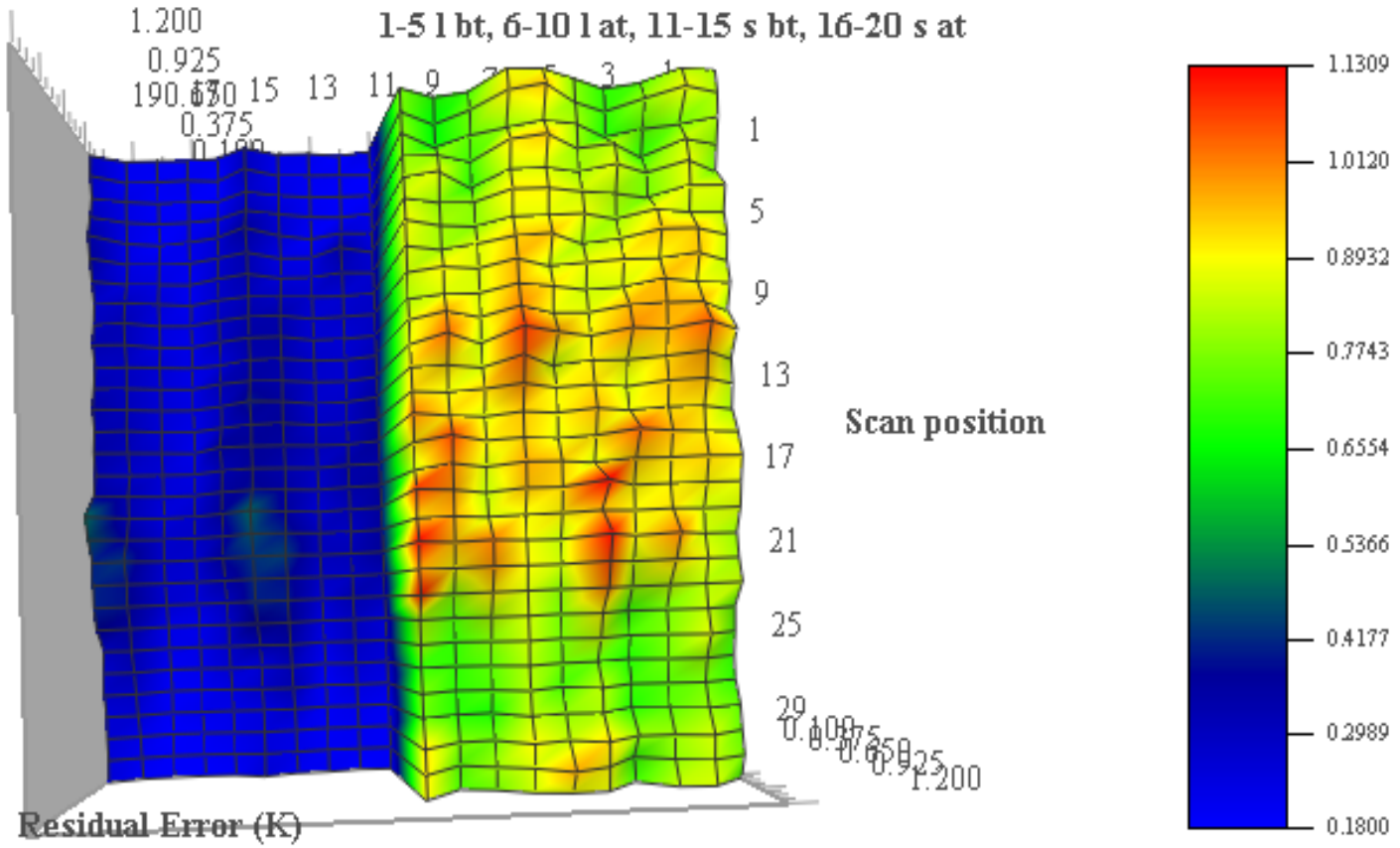
Channel 3 Residuals



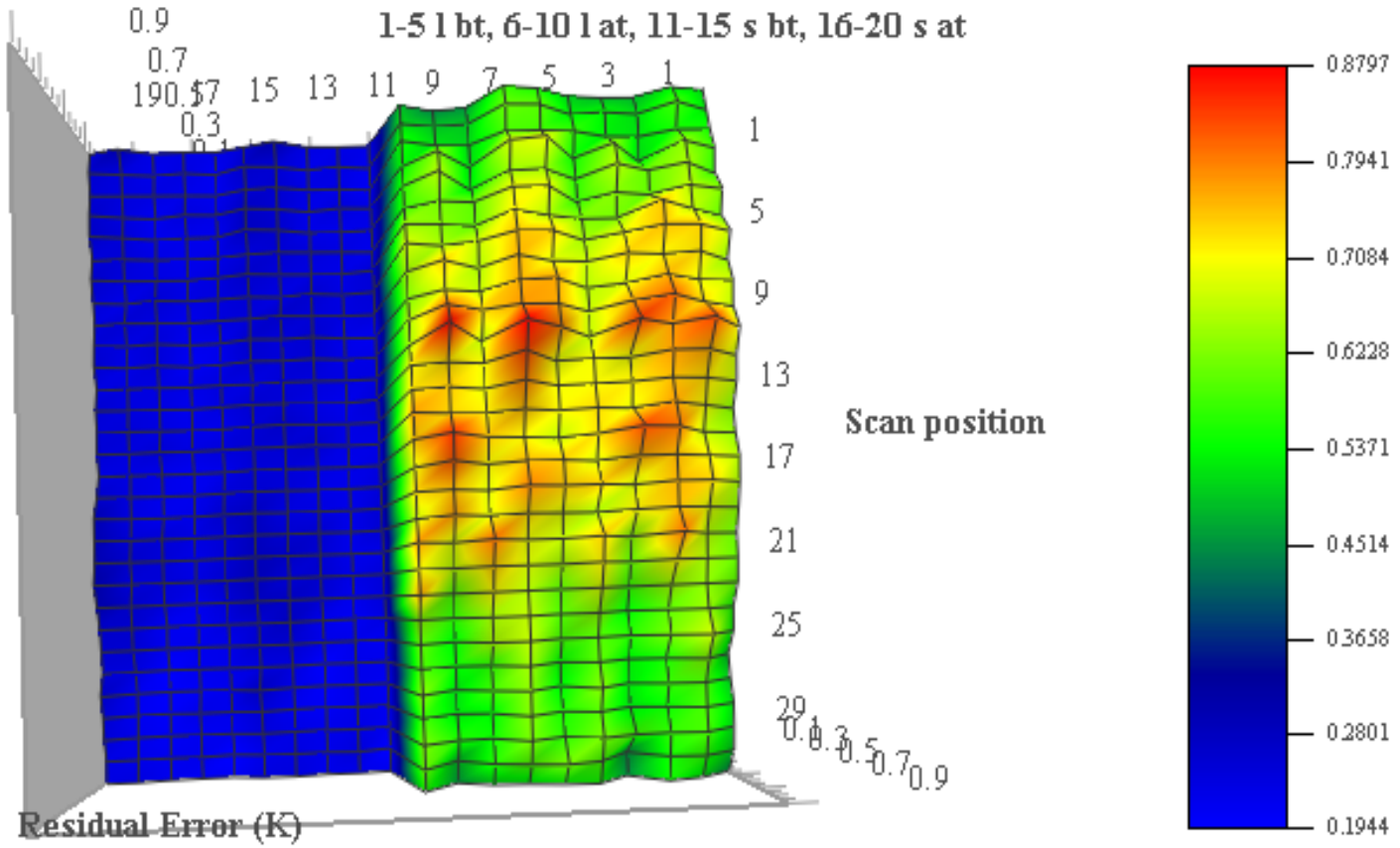
Channel 4 Residuals



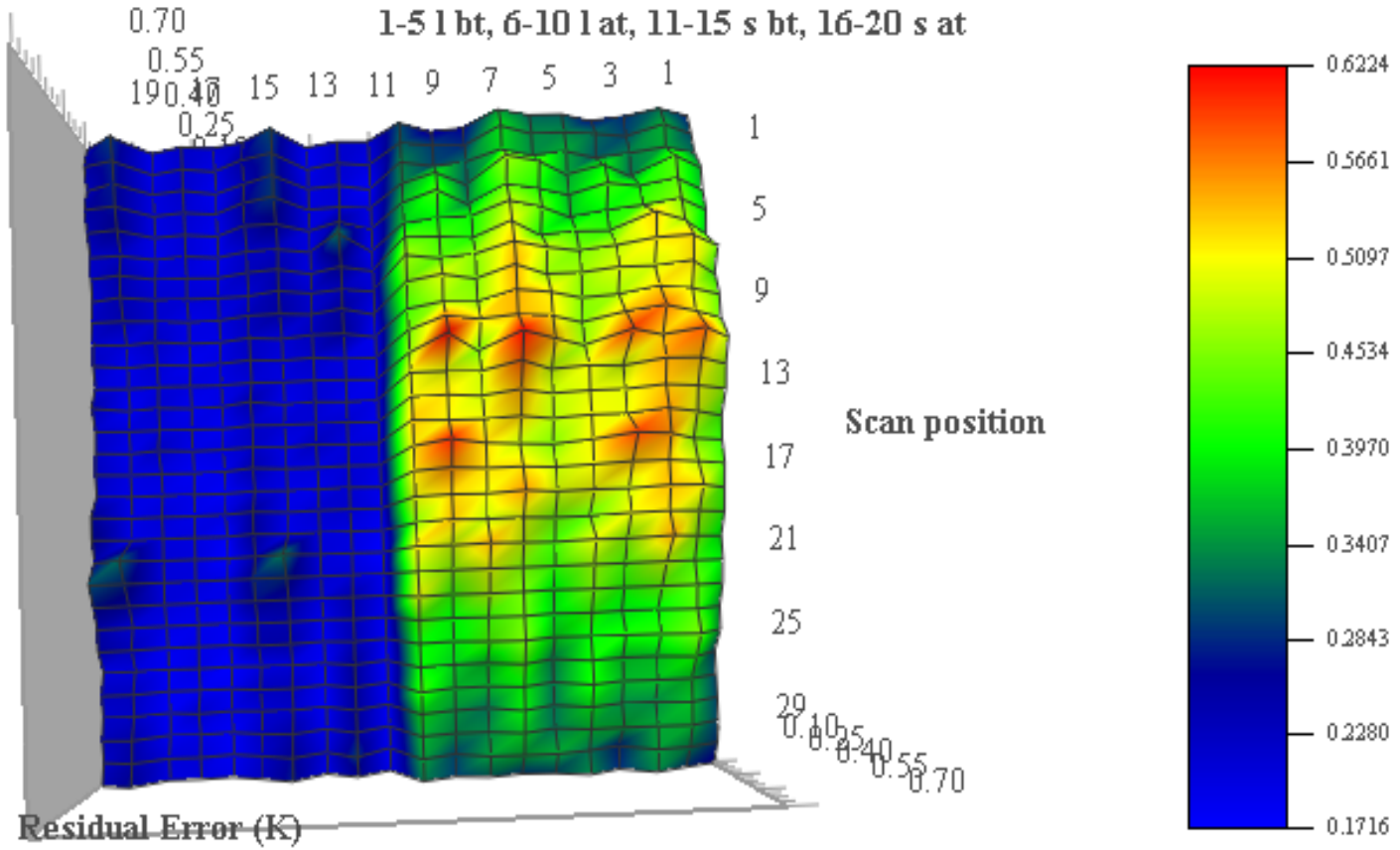
Channel 5 Residuals



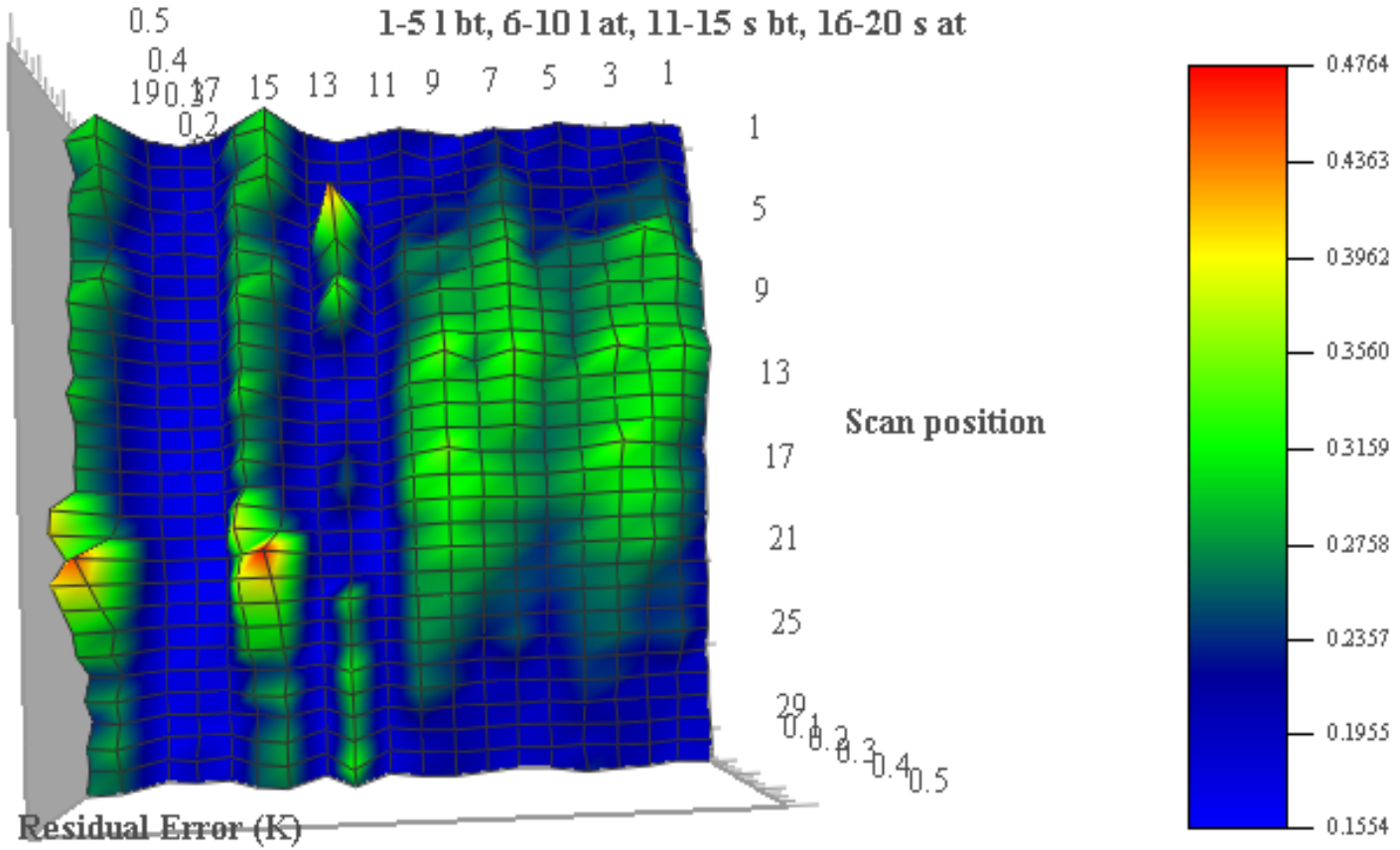
Channel 6 Residuals



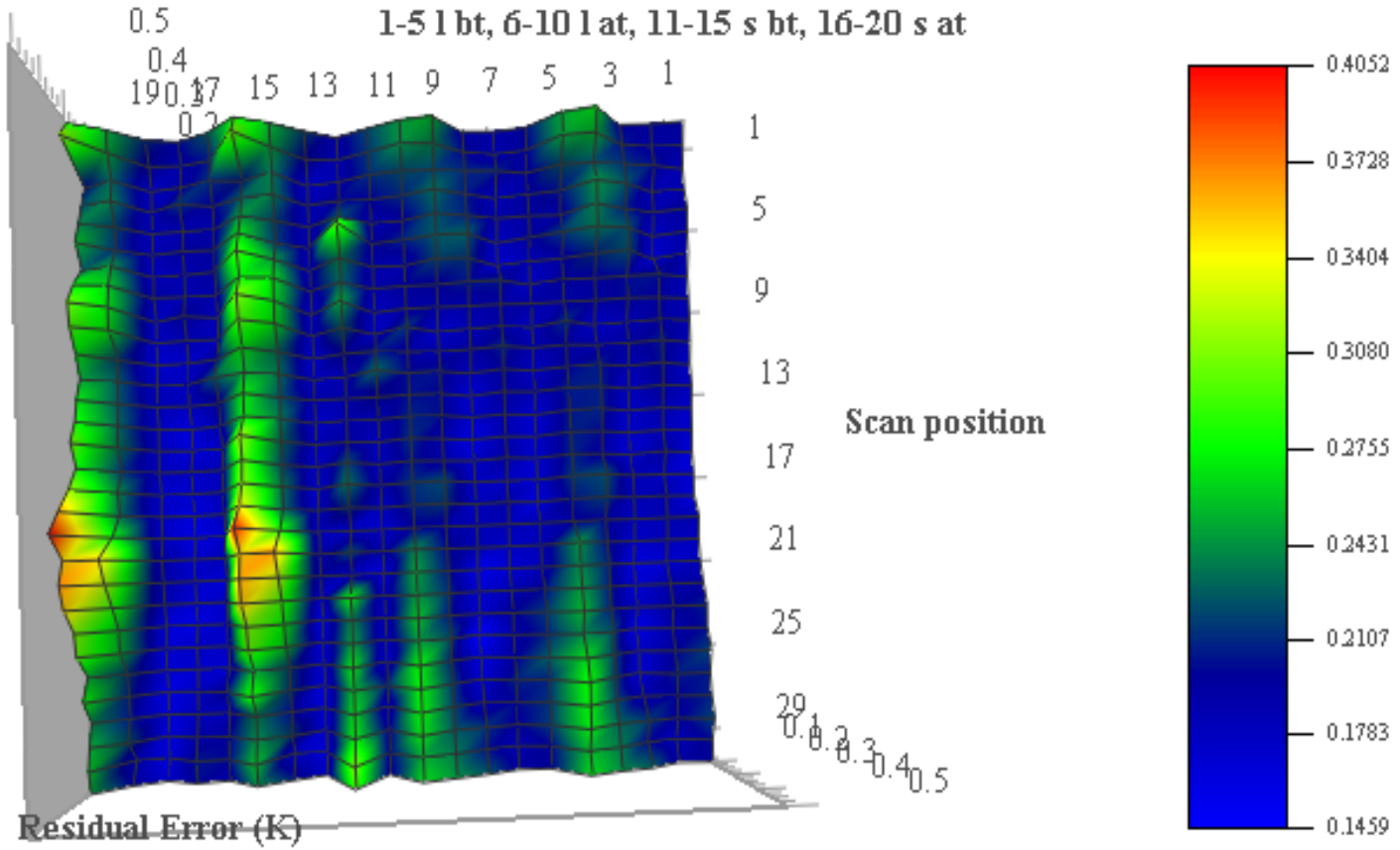
Channel 7 Residuals



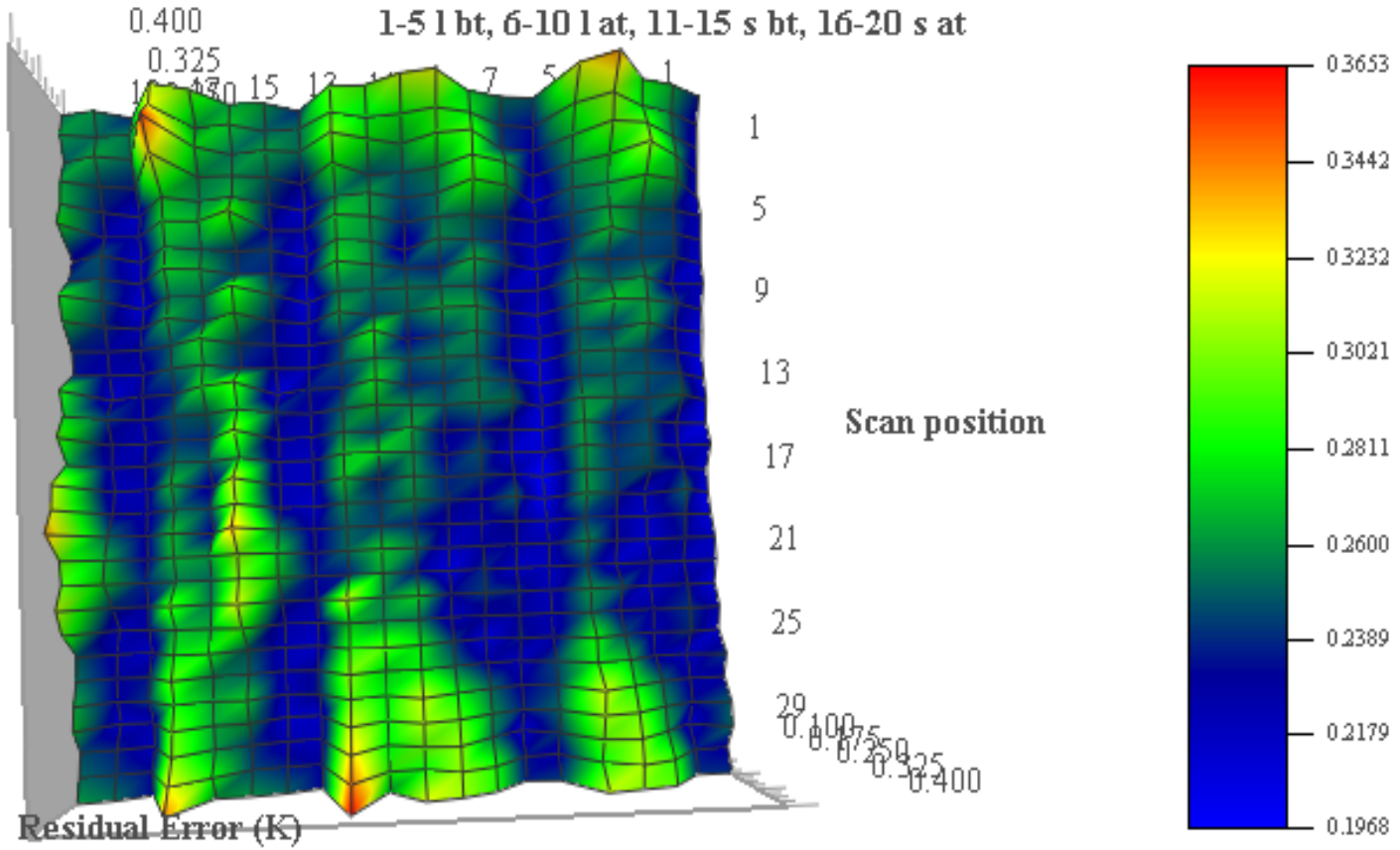
Channel 8 Residuals



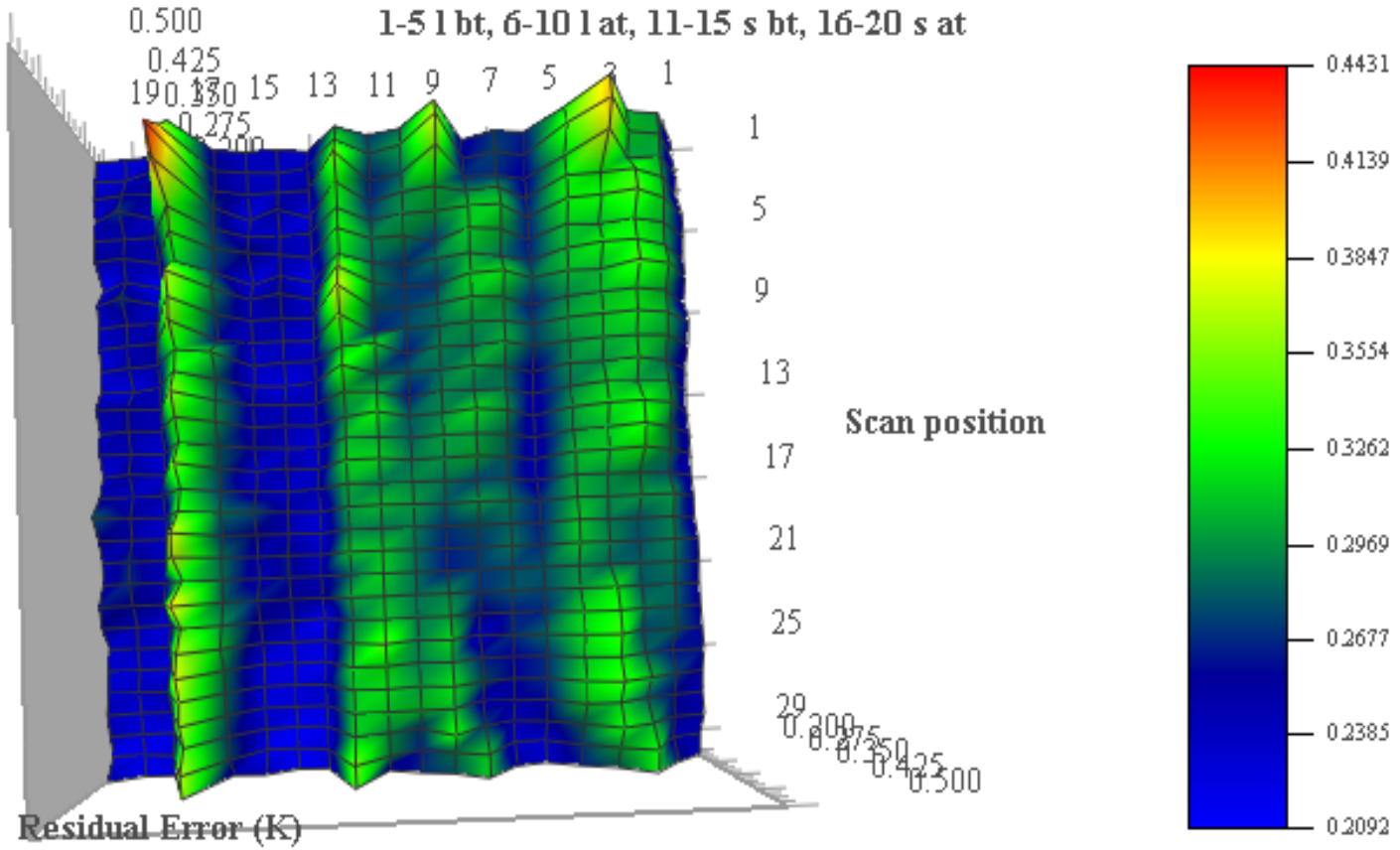
Channel 9 Residuals



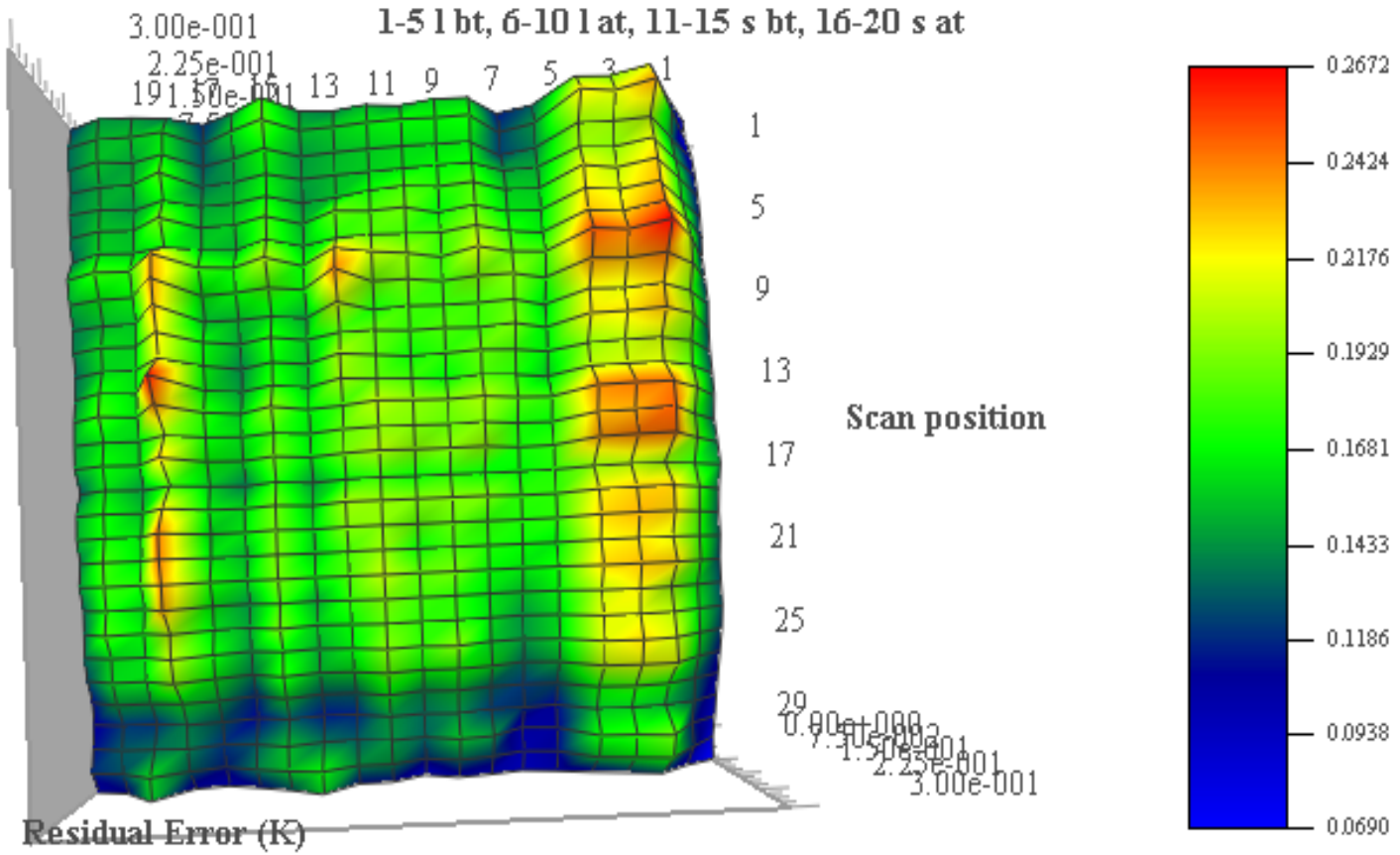
Channel 10 Residuals



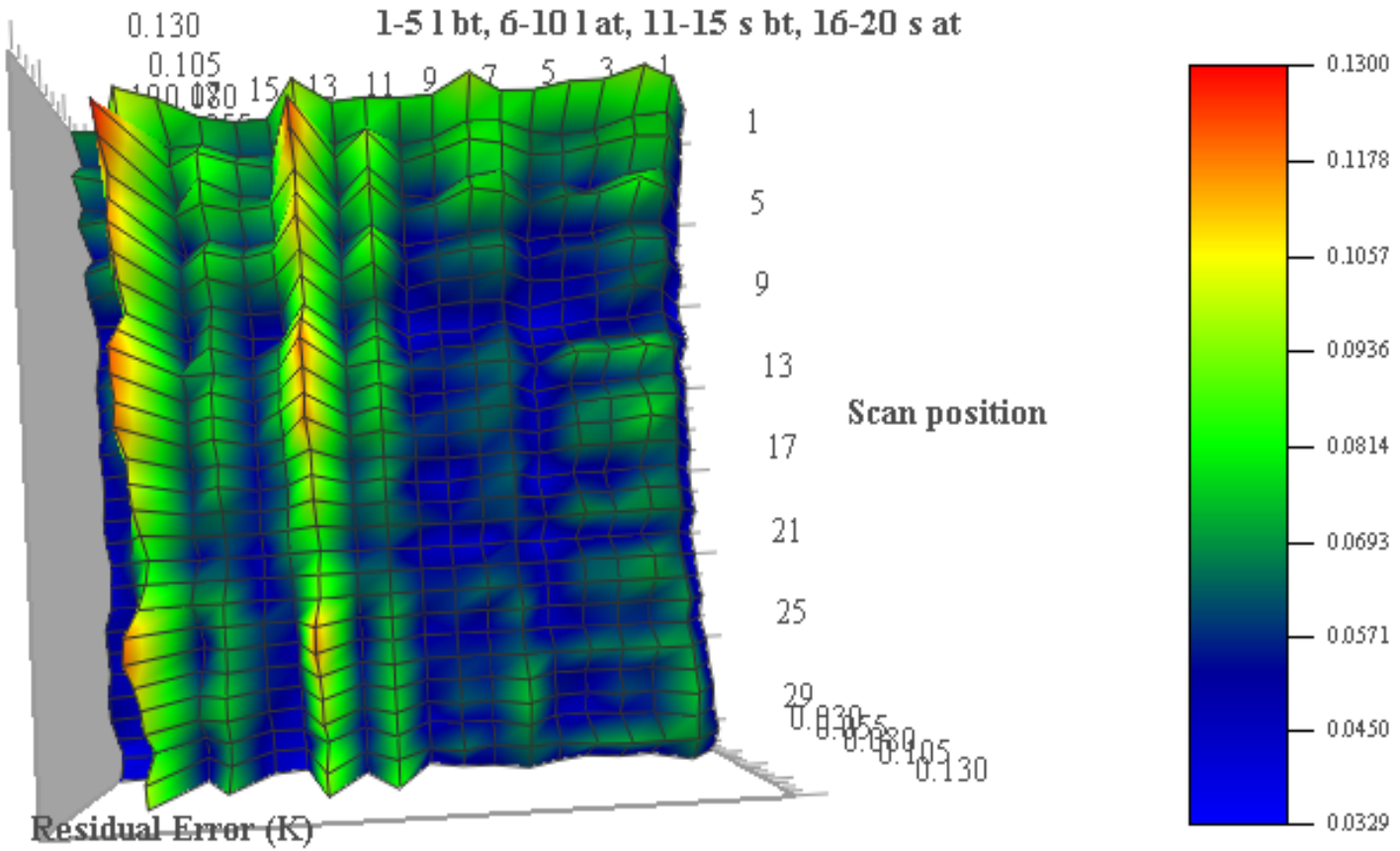
Channel 11 Residuals



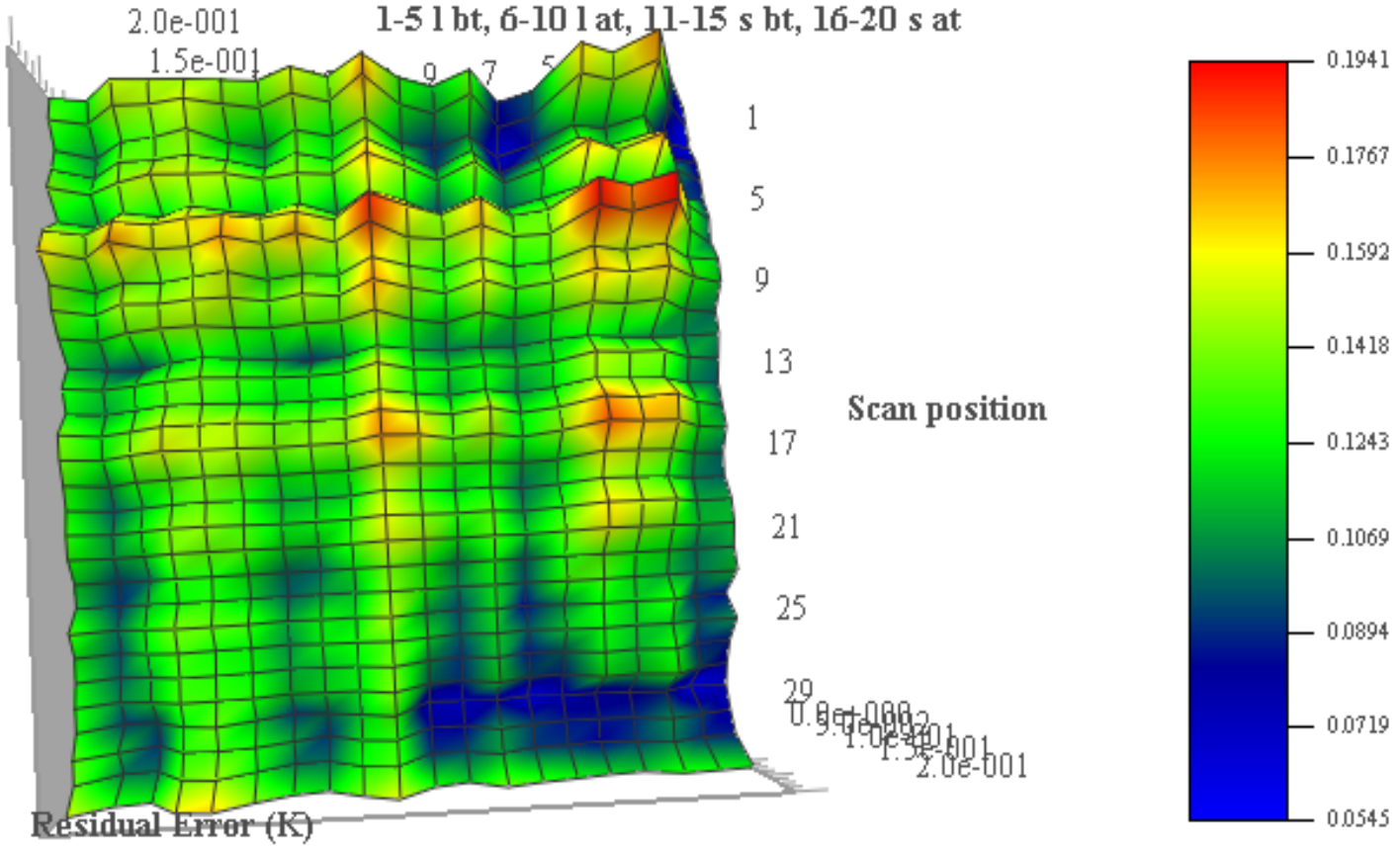
Channel 12 Residuals



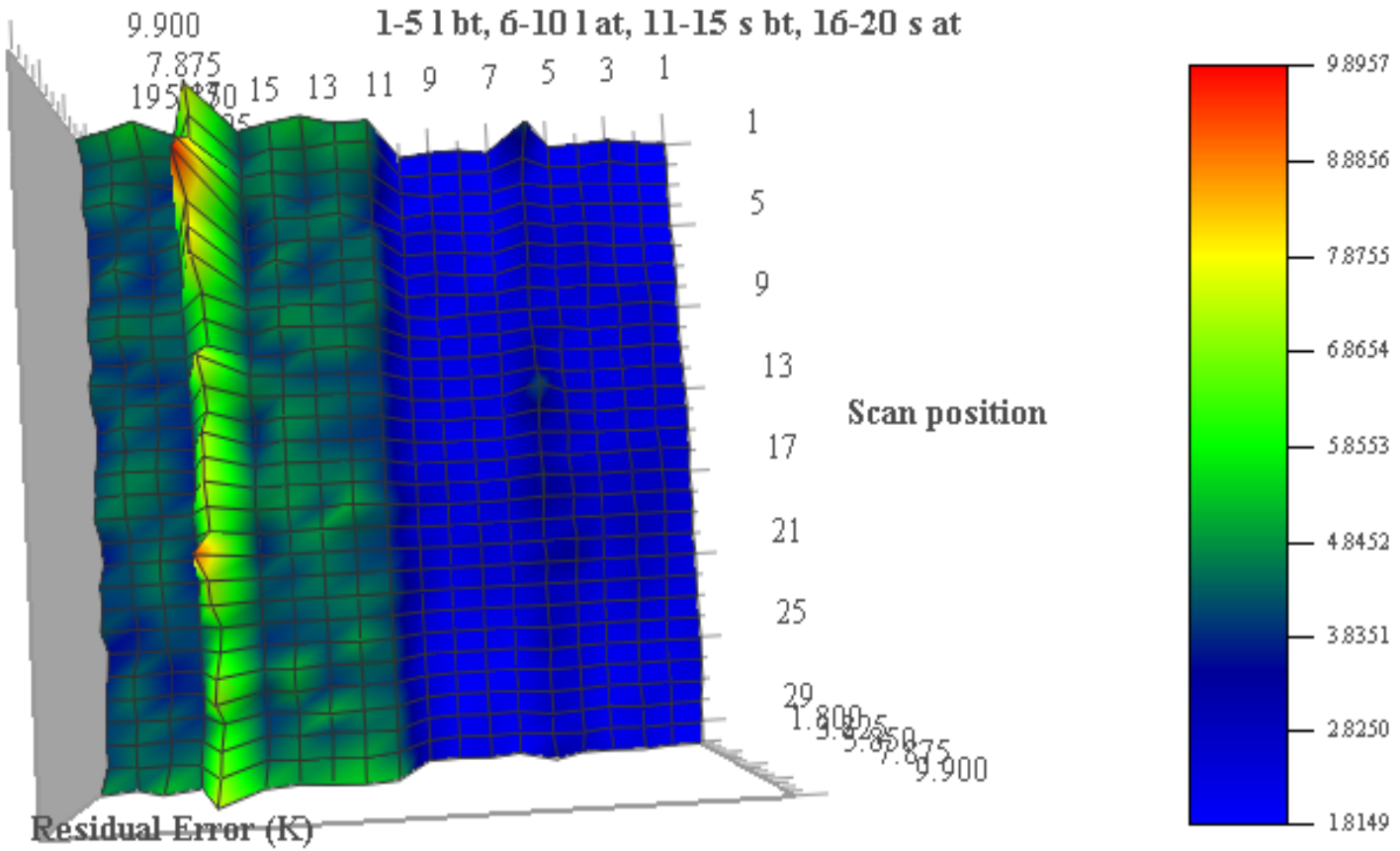
Channel 13 Residuals



Channel 14 Residuals



Channel 15 Residuals



Conclusions

- The current bias adjustment makes some cases better and some worse. Overall it may be slightly better to skip it, but the difference is mixed and extremely subtle.

Oct. 21 AIRS Meeting - AIRS Tuning Results

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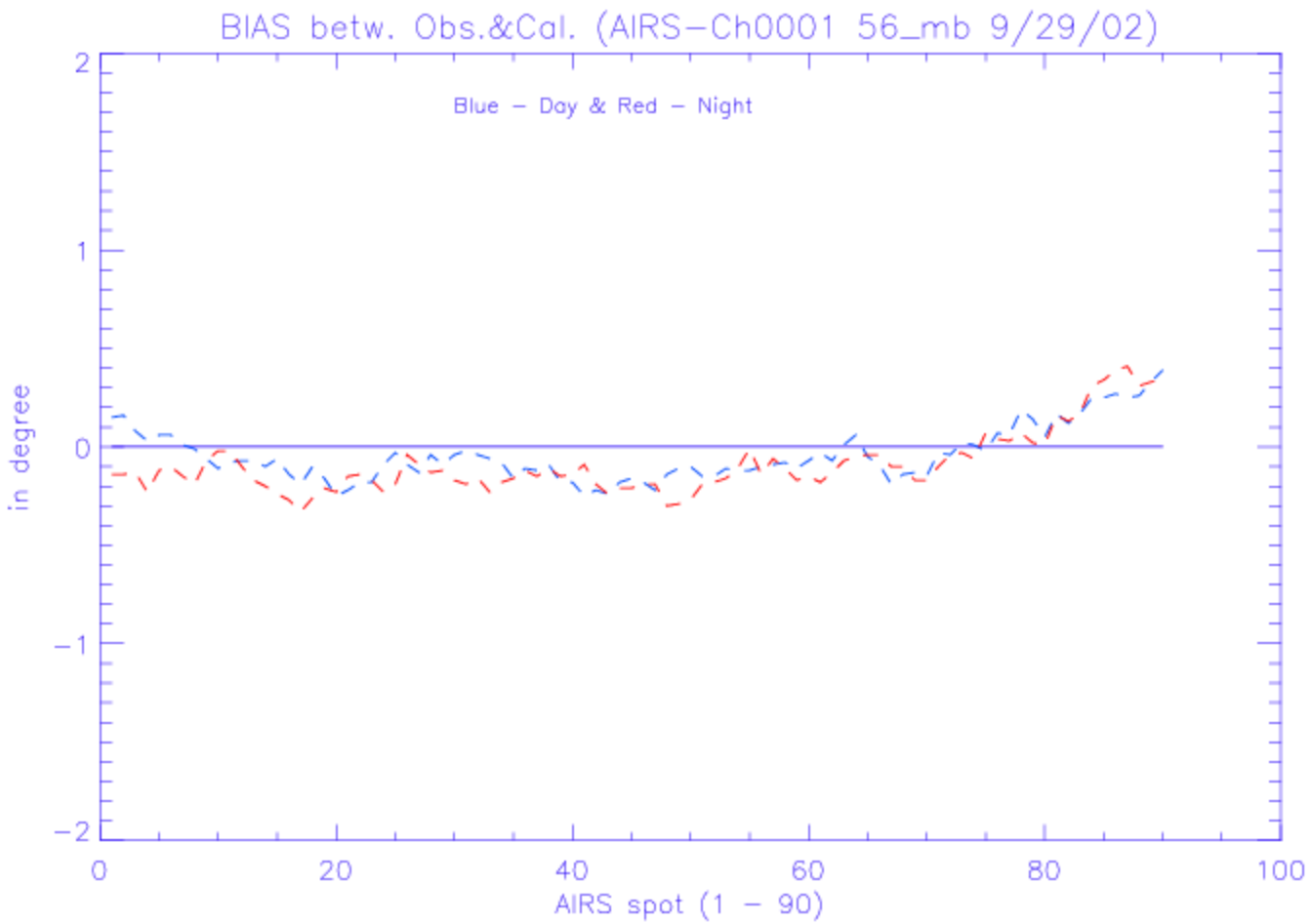
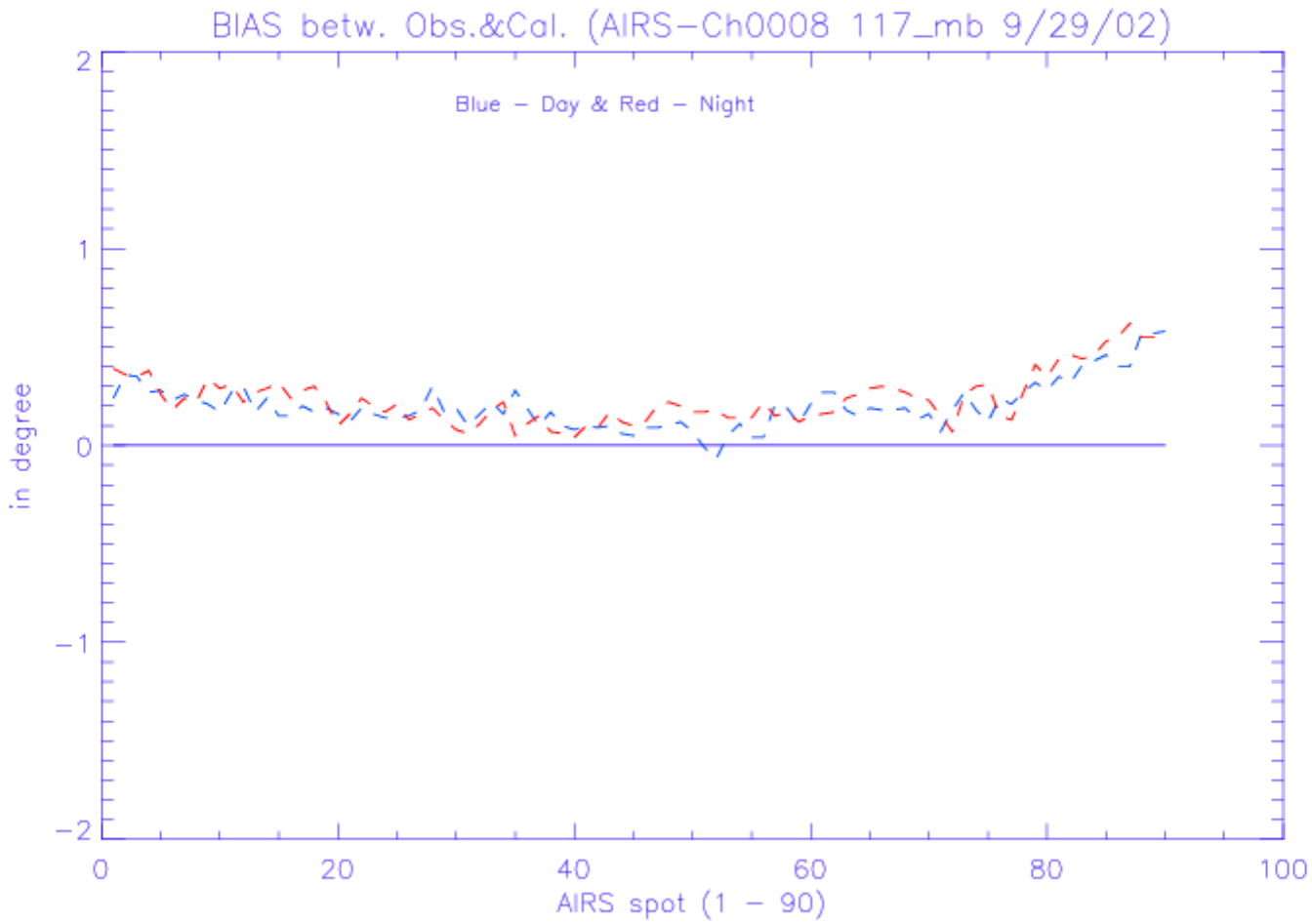
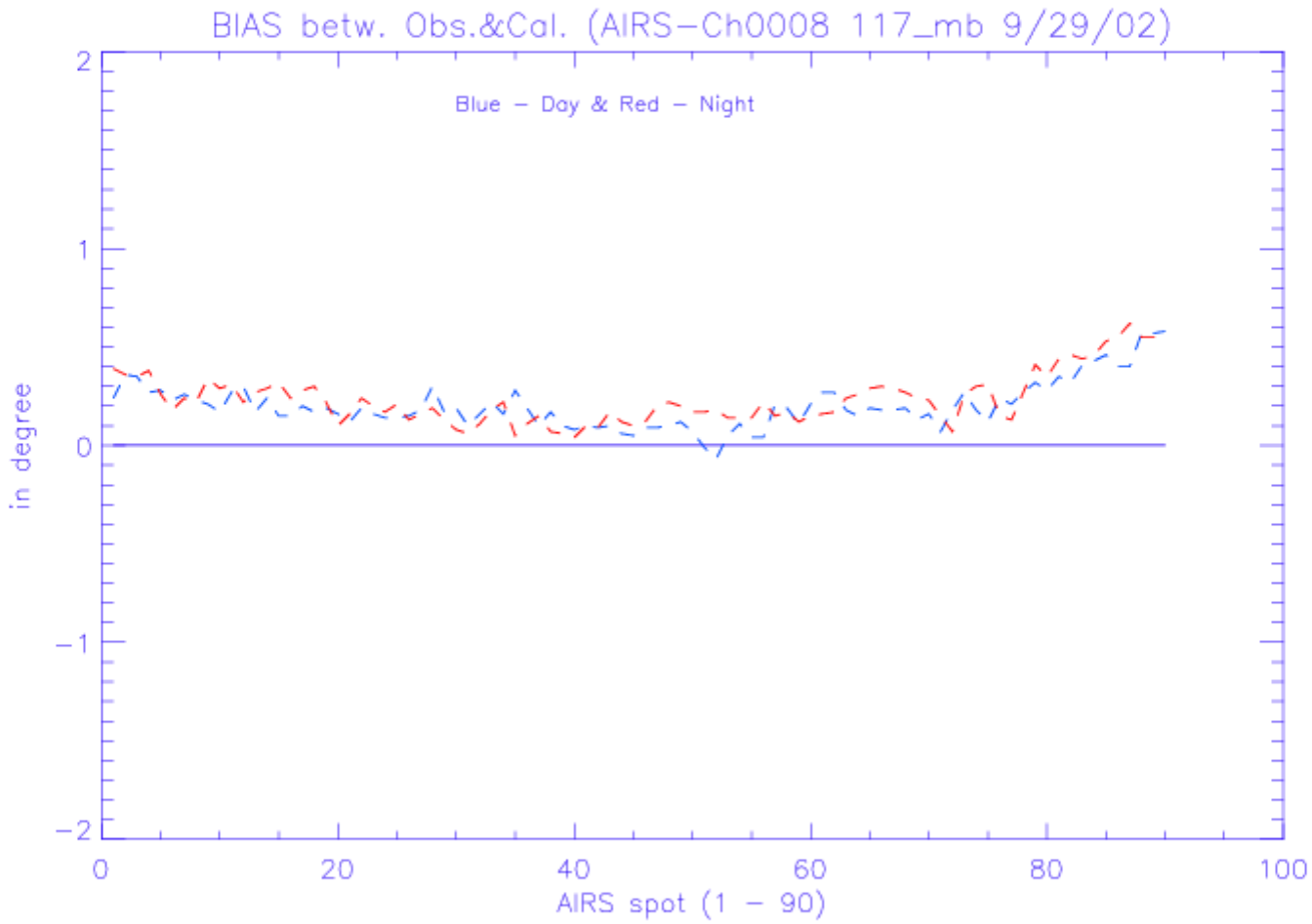
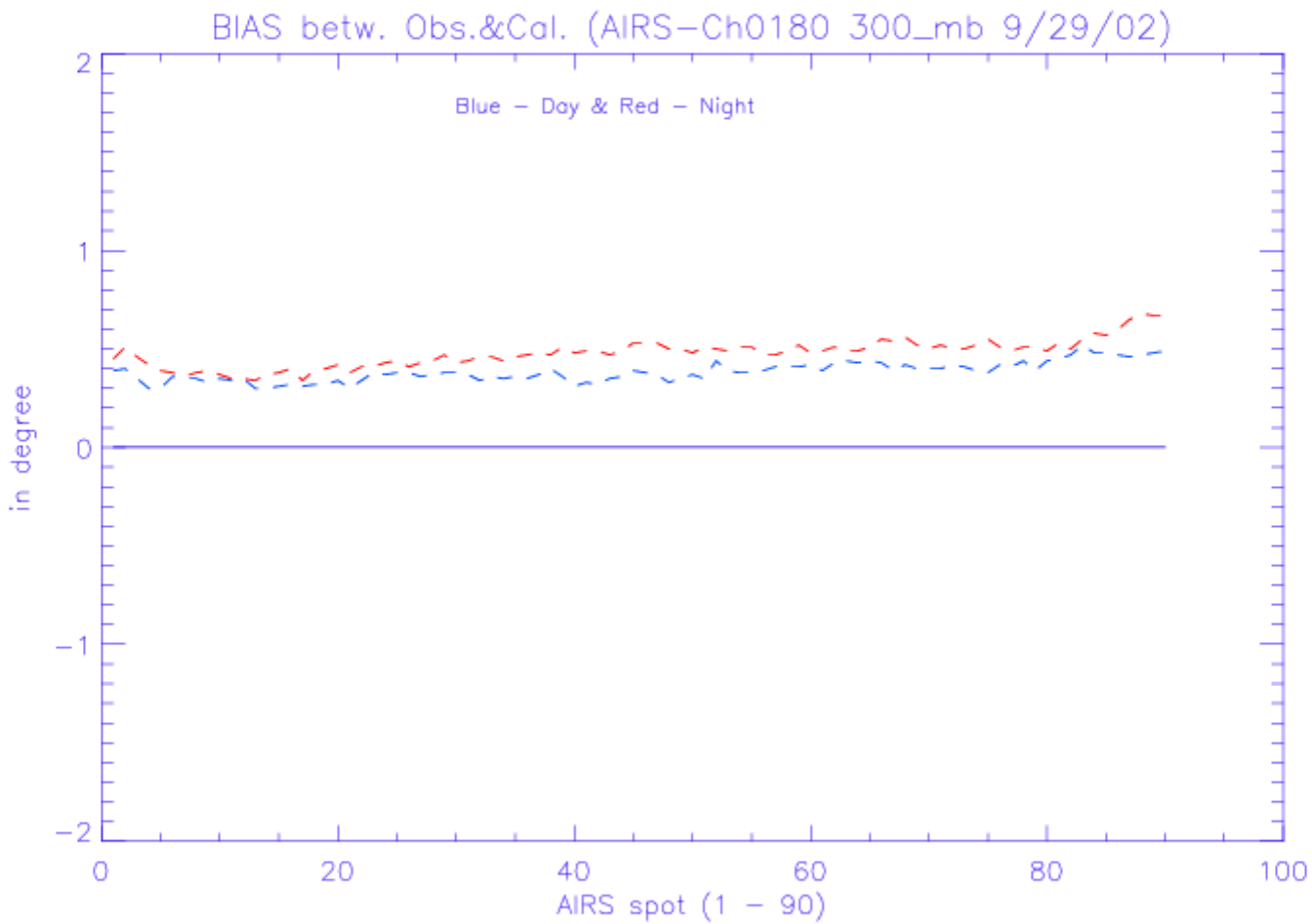
AIRS Bias Adjustments

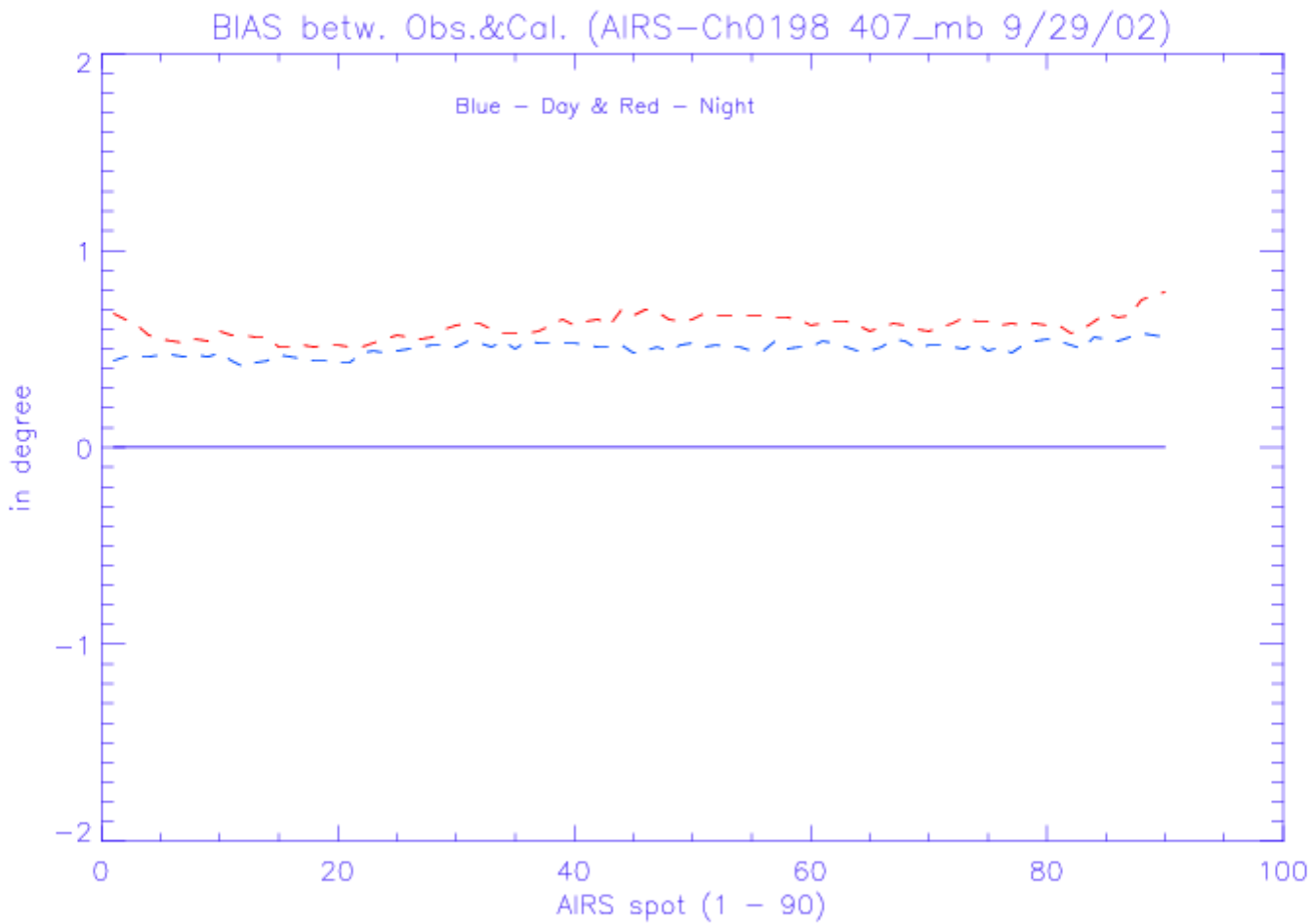
- Data are screened for uniformity to select clear areas
- Constraint is tighter at the edge due to limb effects
- The smallest spot is selected
- Each spot in the smallest sample is matched with its closest match in each of other spot samples
- This gives the same number of spots in each sample and tends to minimize sample differences between spots

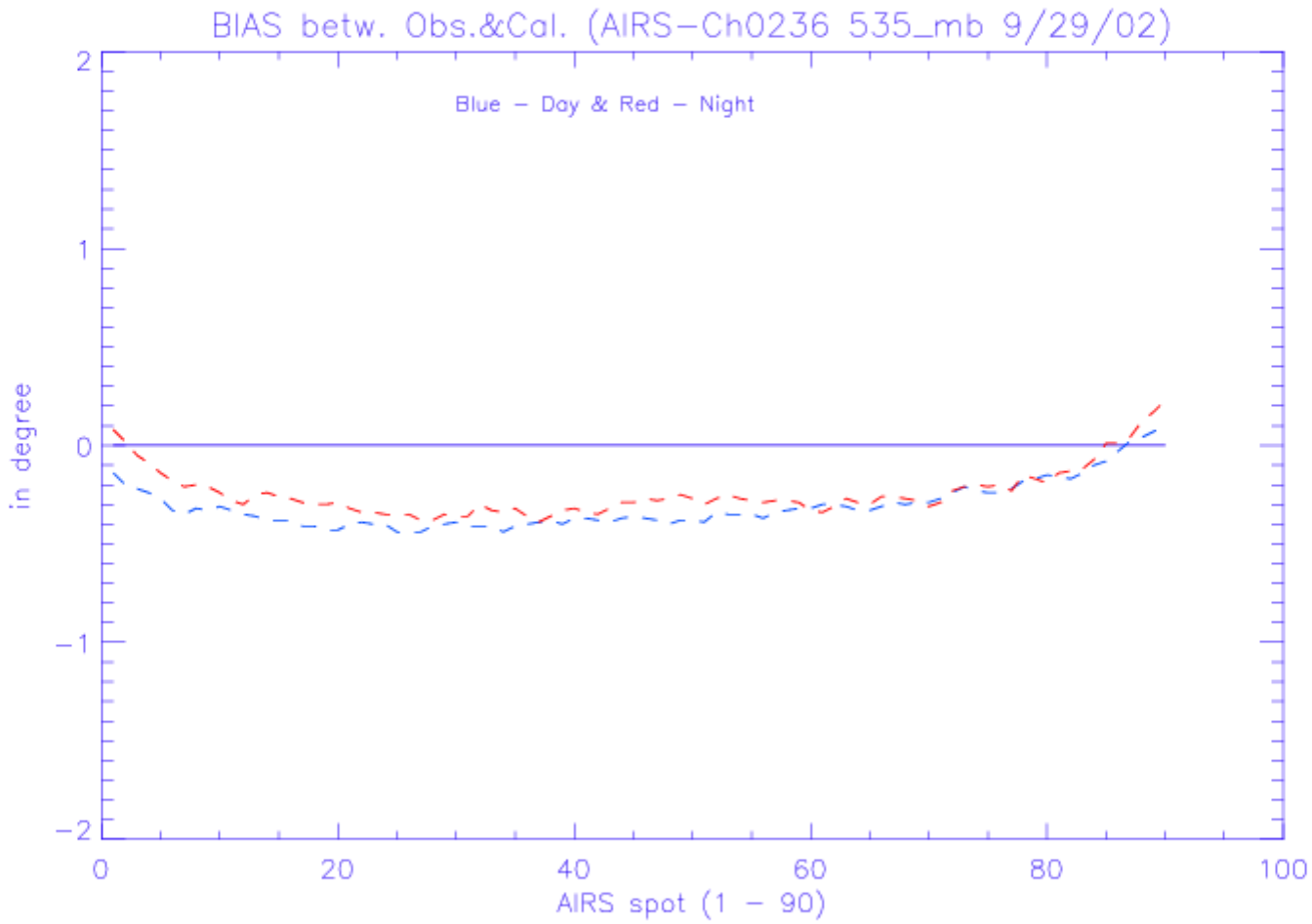

BIAS betw. Obs.&Cal. (AIRS-Ch0001 56_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

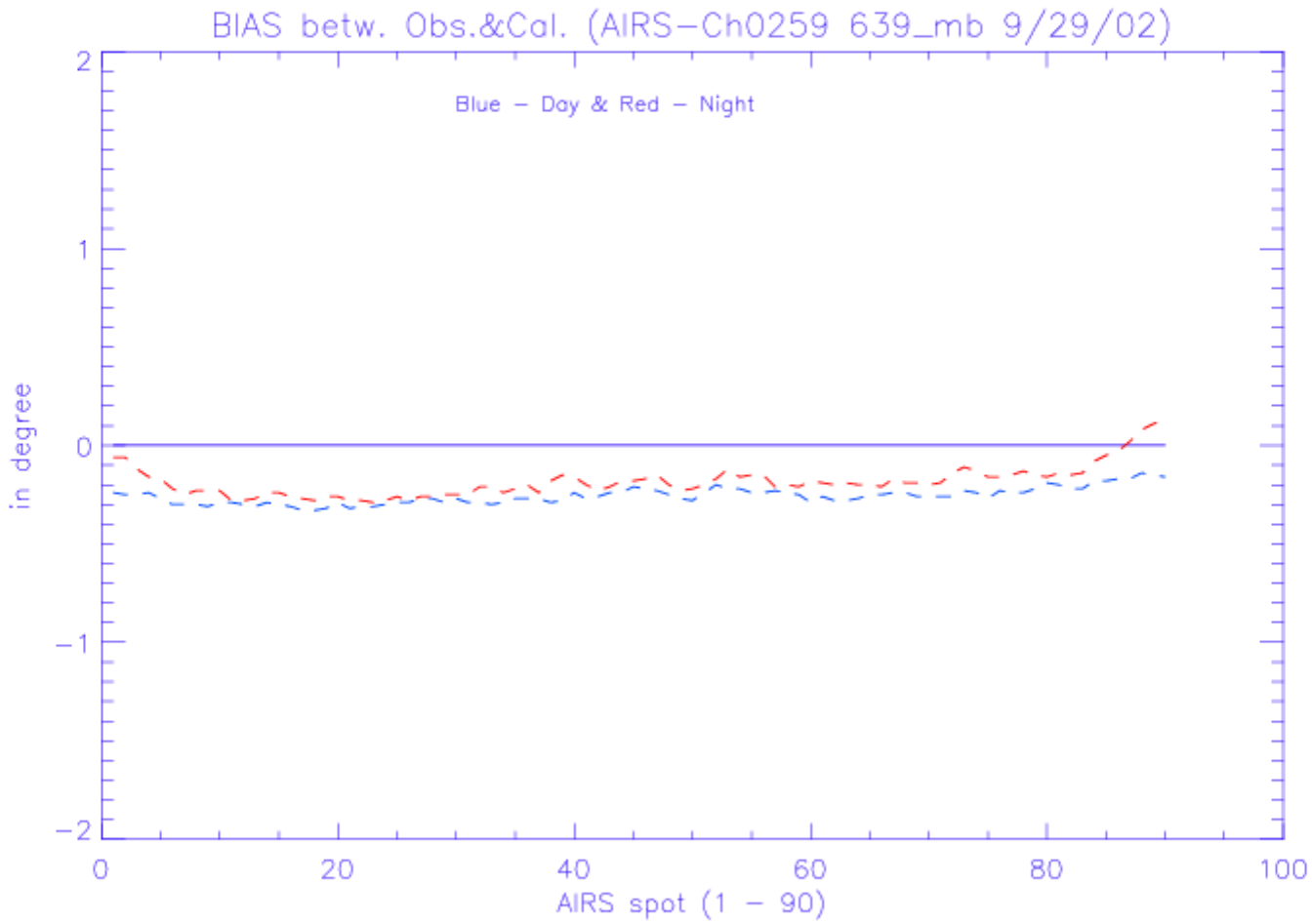

BIAS betw. Obs.&Cal. (AIRS-Ch0008 117_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

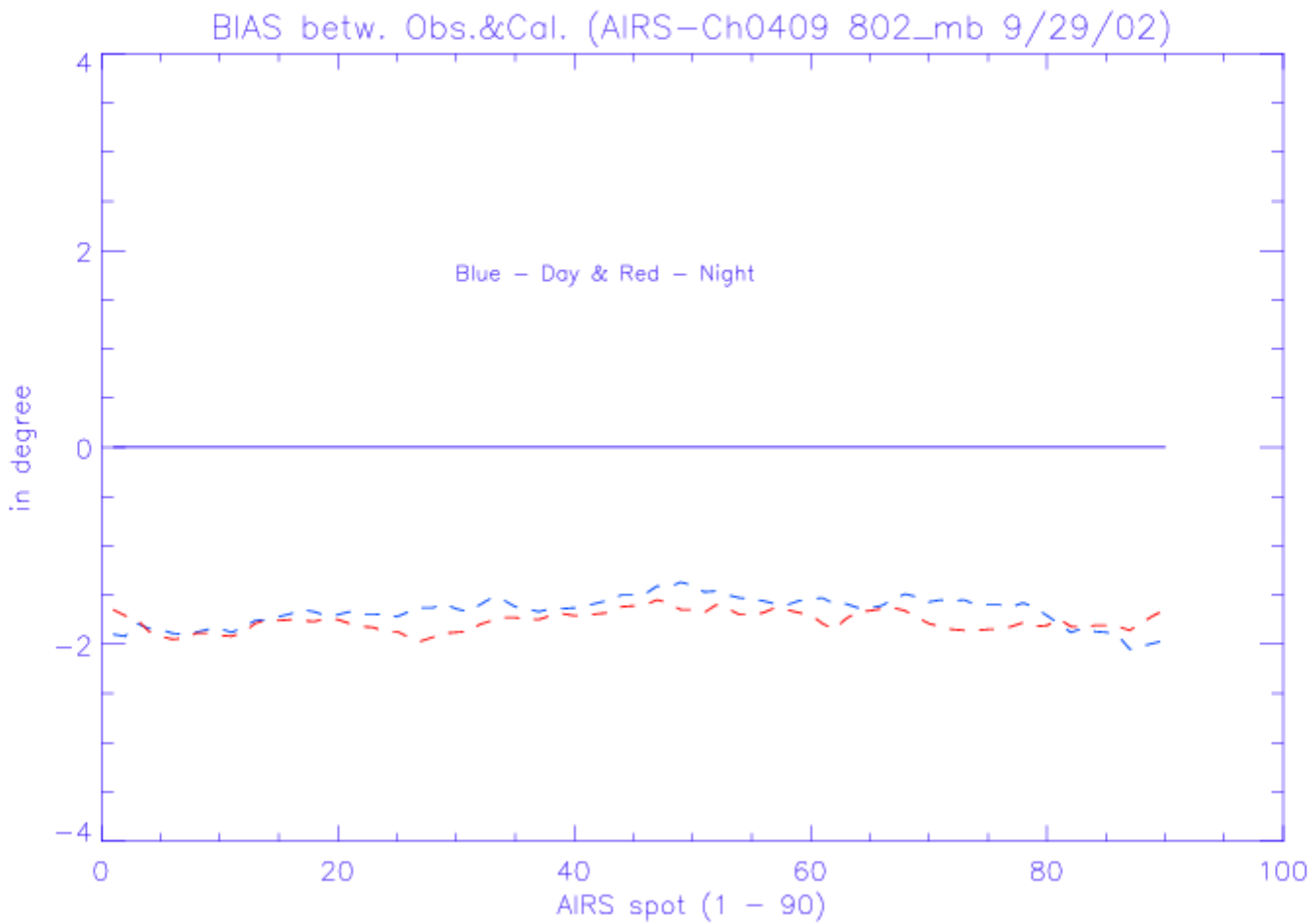

BIAS betw. Obs.&Cal. (AIRS-Ch0008 117_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

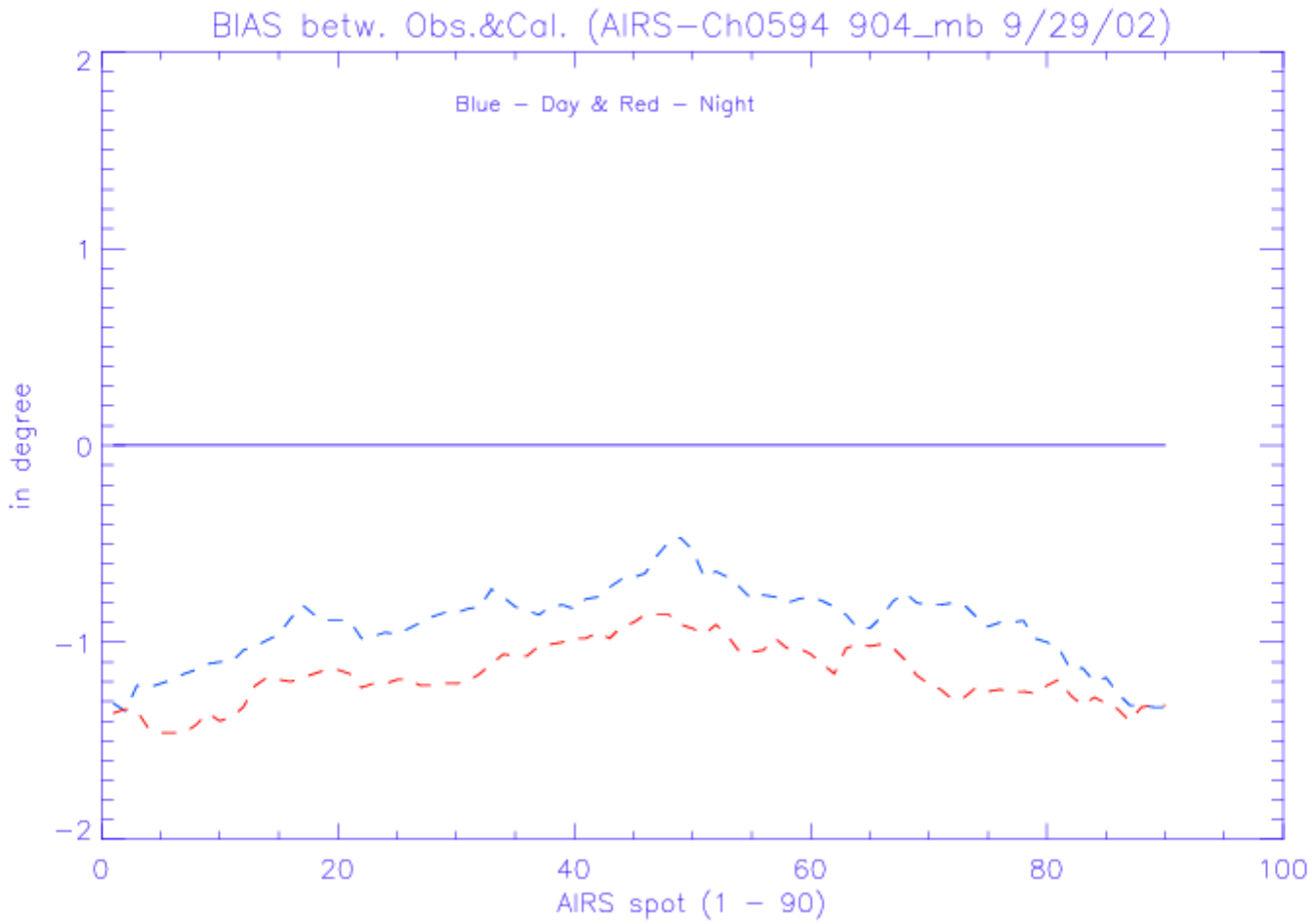

BIAS betw. Obs.&Cal. (AIRS-Ch0180 300_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

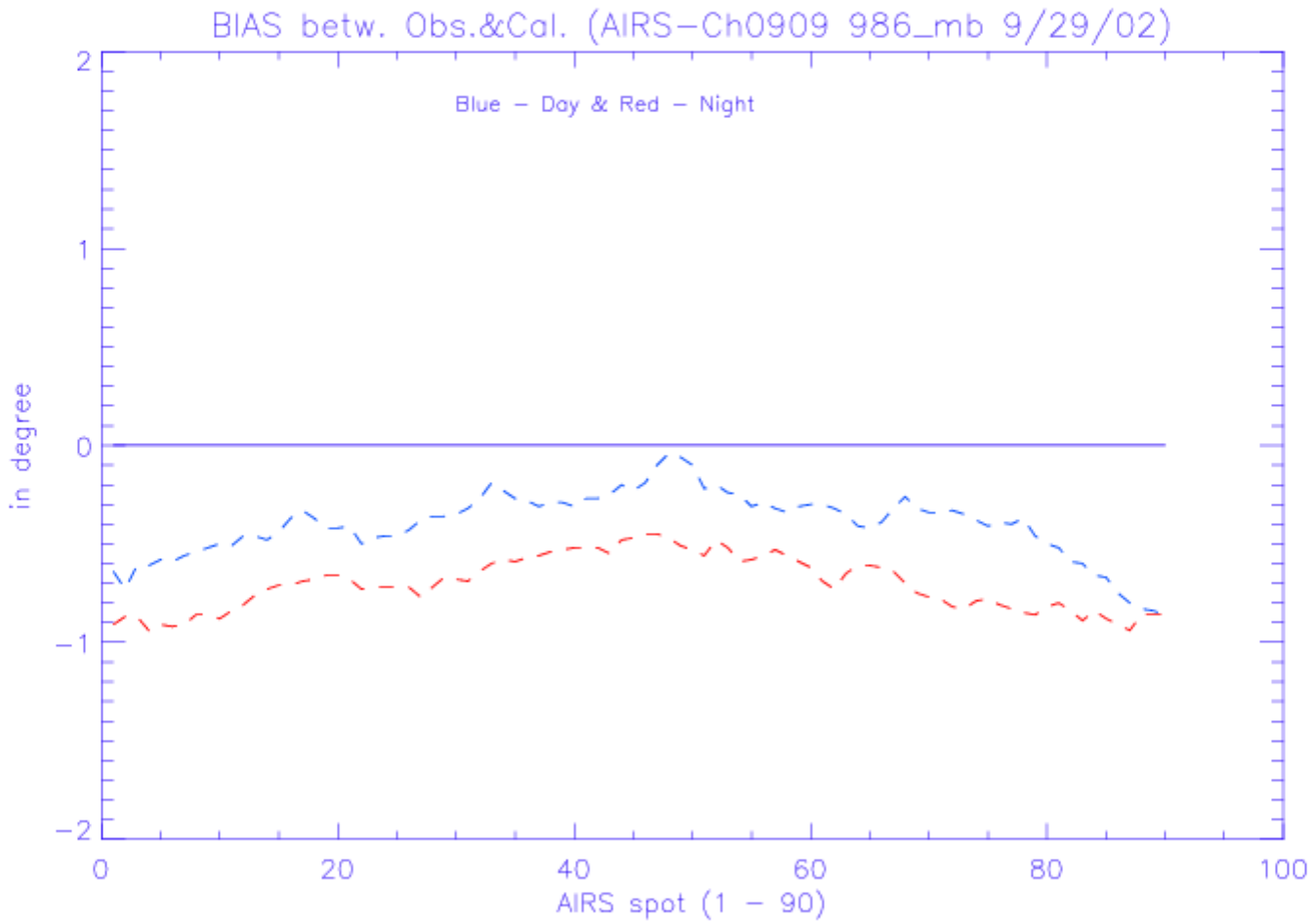

BIAS betw. Obs.&Cal. (AIRS-Ch0198 407_mb 9/29/02)
Blue - Day & Red - Night
2
1
0
-1
-2
in degree
0
20
40
60
80
100
AIRS spot (1 - 90)

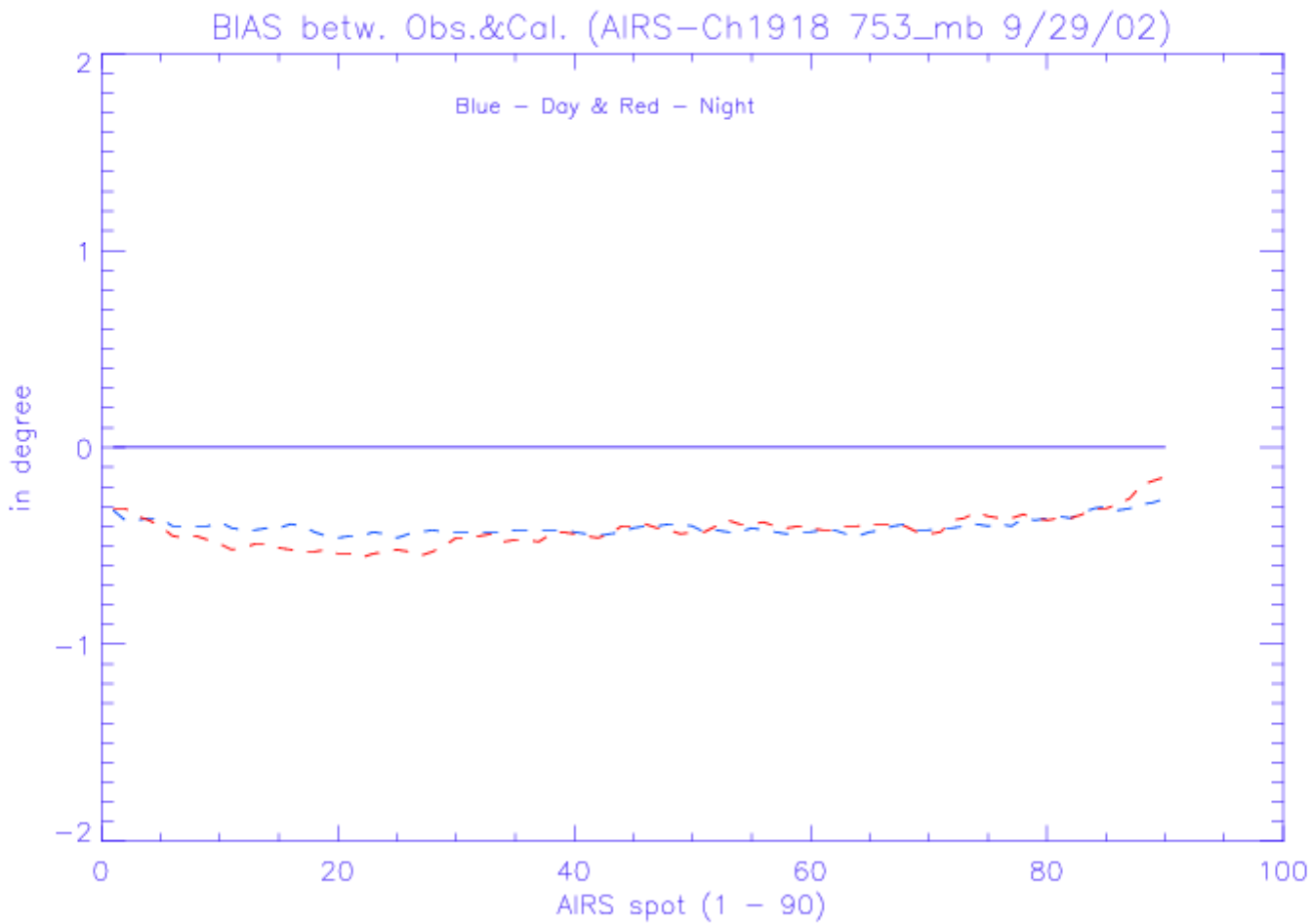

BIAS betw. Obs.&Cal. (AIRS-Ch0236 535_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

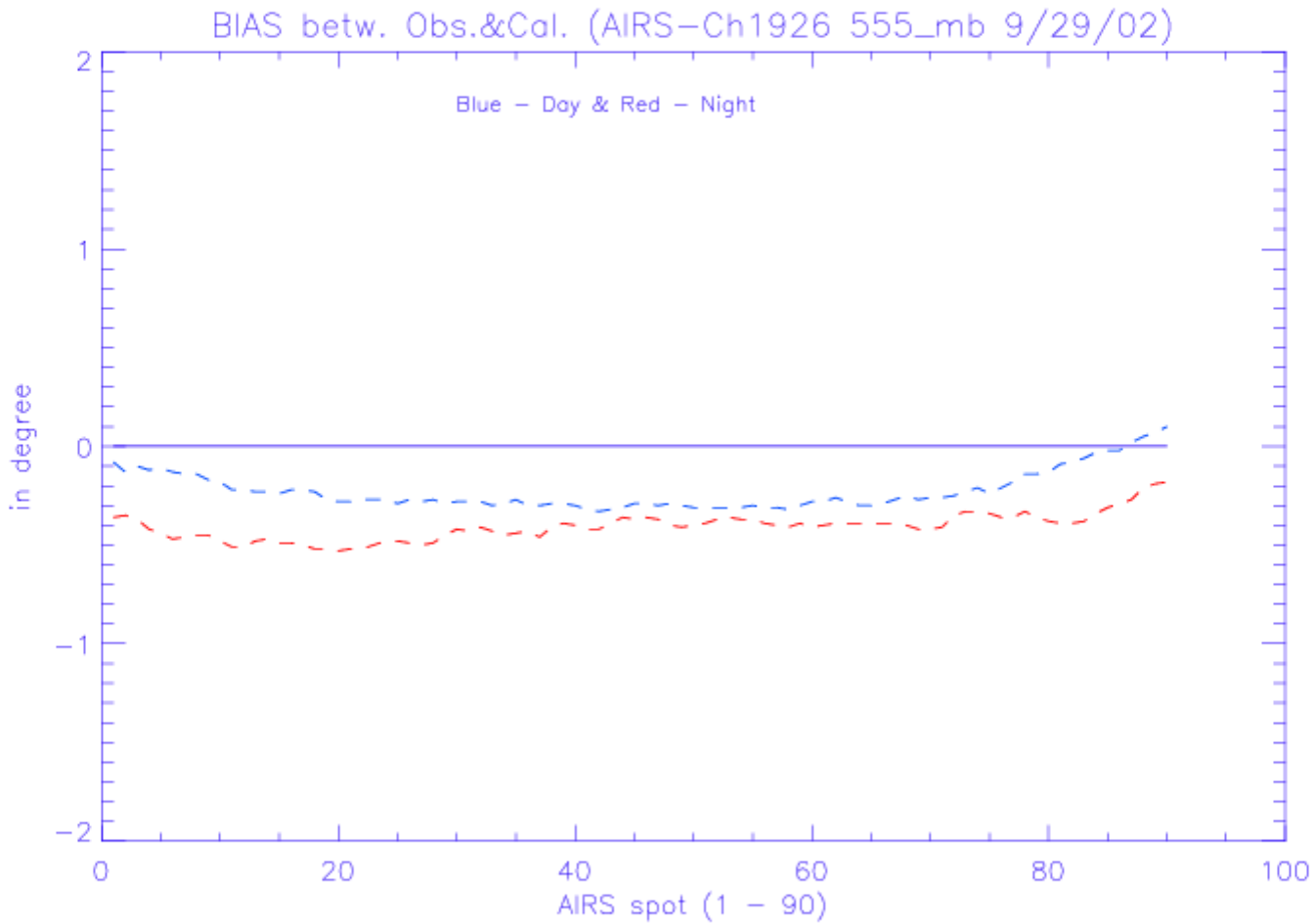

BIAS betw. Obs.&Cal. (AIRS-Ch0259 639_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

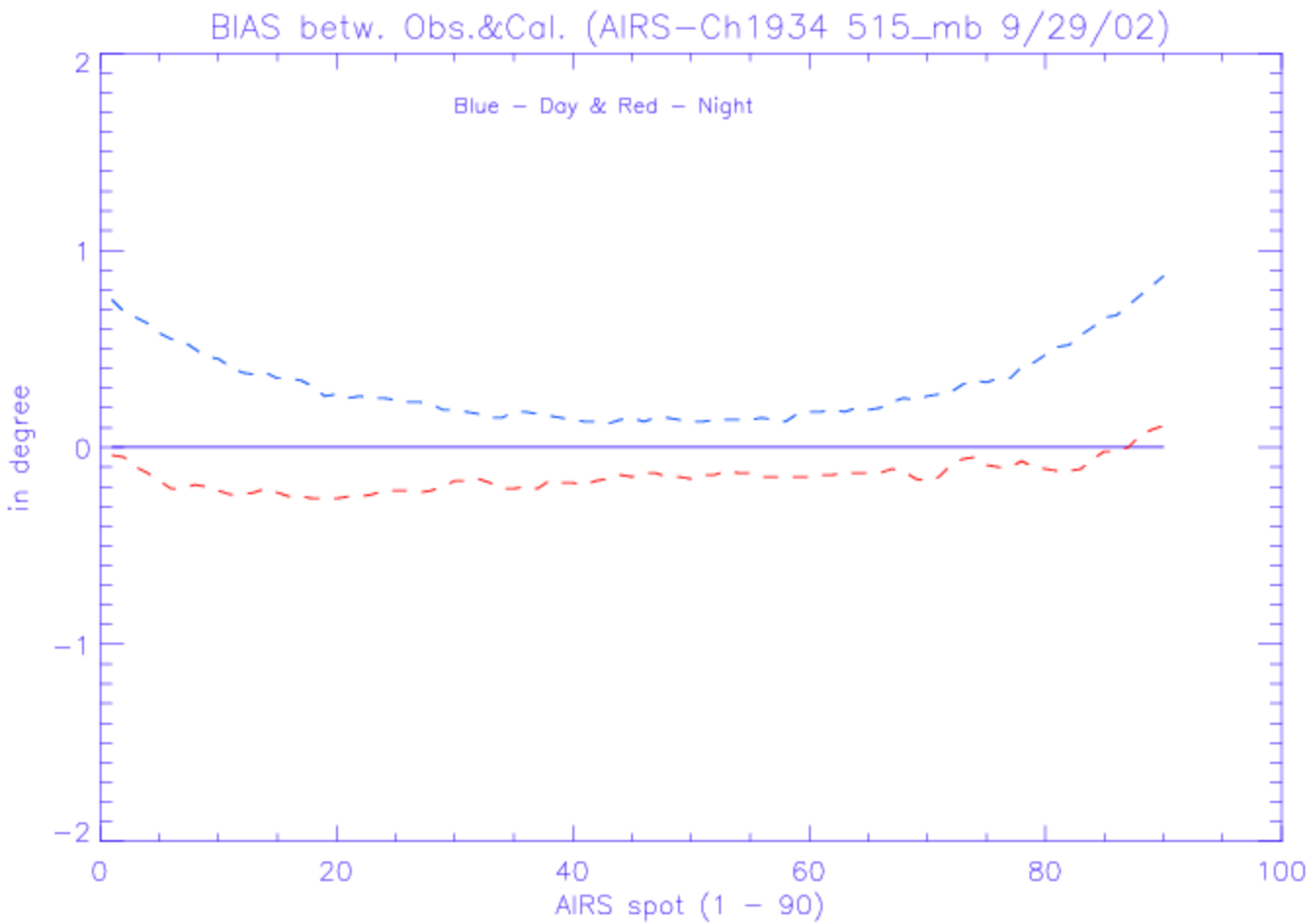

BIAS betw. Obs.&Cal. (AIRS-Ch0409 802_mb 9/29/02)
Blue - Day & Red - Night
in degree
4
2
0
-2
-4
0
20
40
60
80
100
AIRS spot (1 - 90)

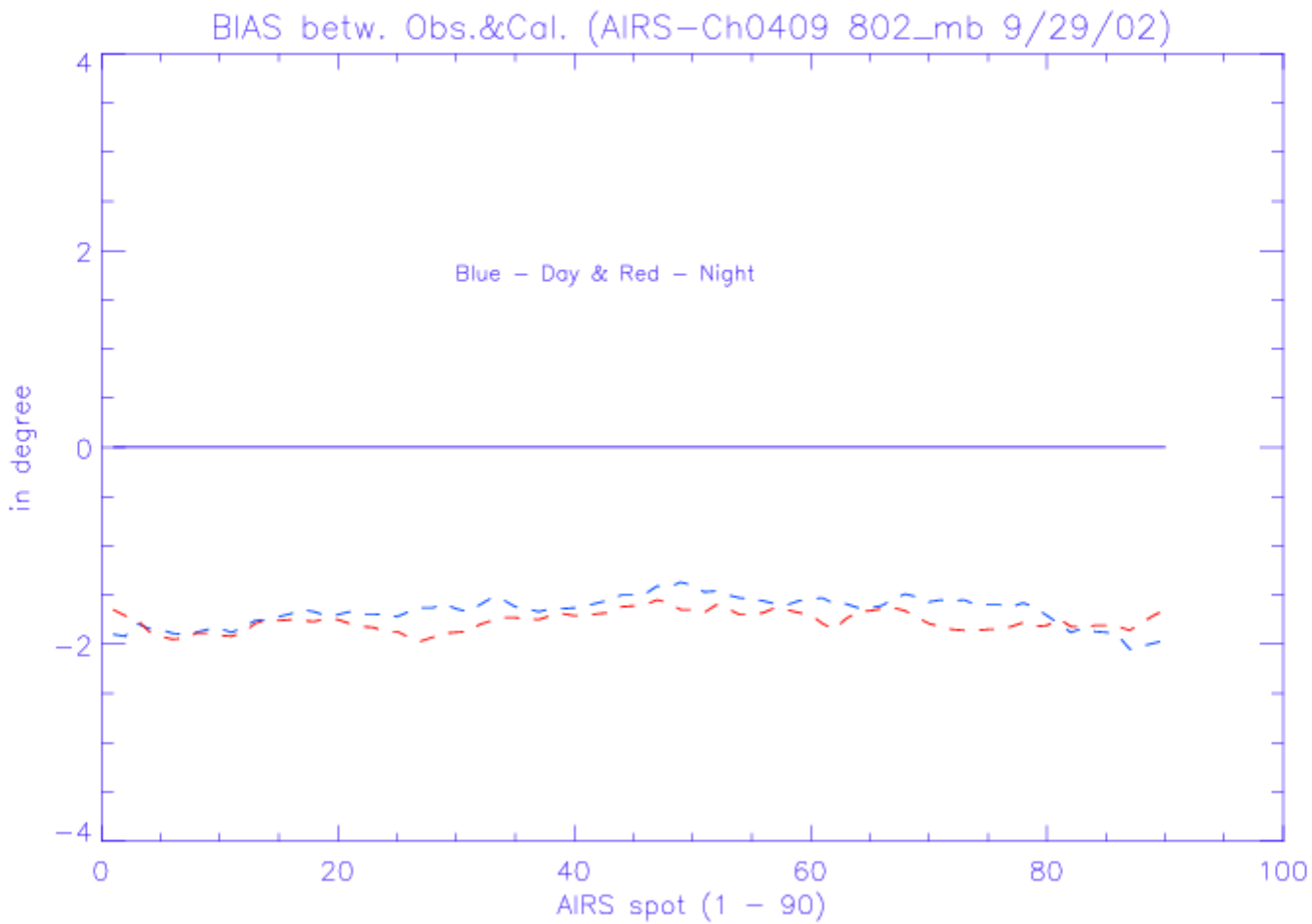

BIAS betw. Obs.&Cal. (AIRS-Ch0594 904_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

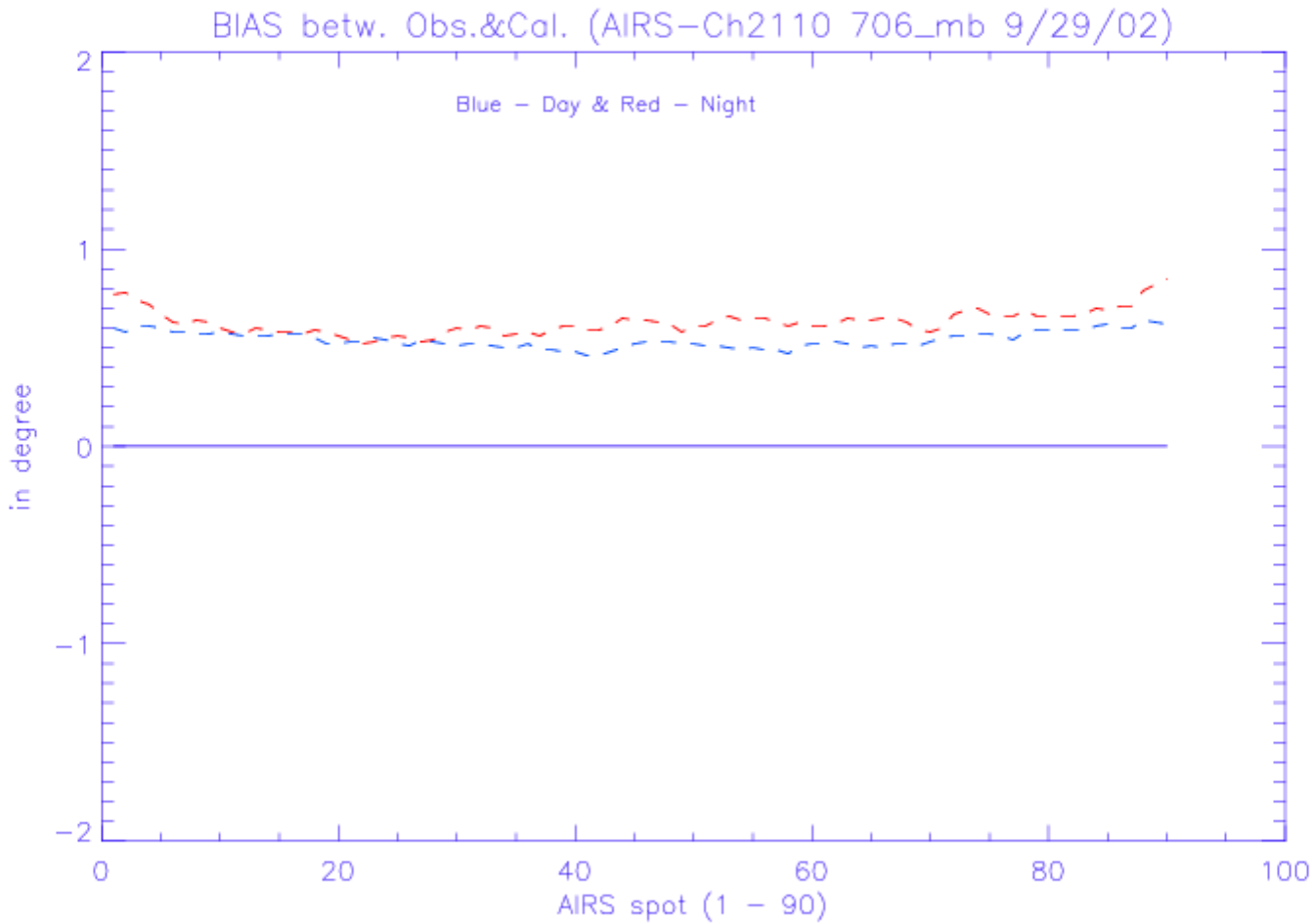

BIAS betw. Obs.&Cal. (AIRS-Ch0909 986_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

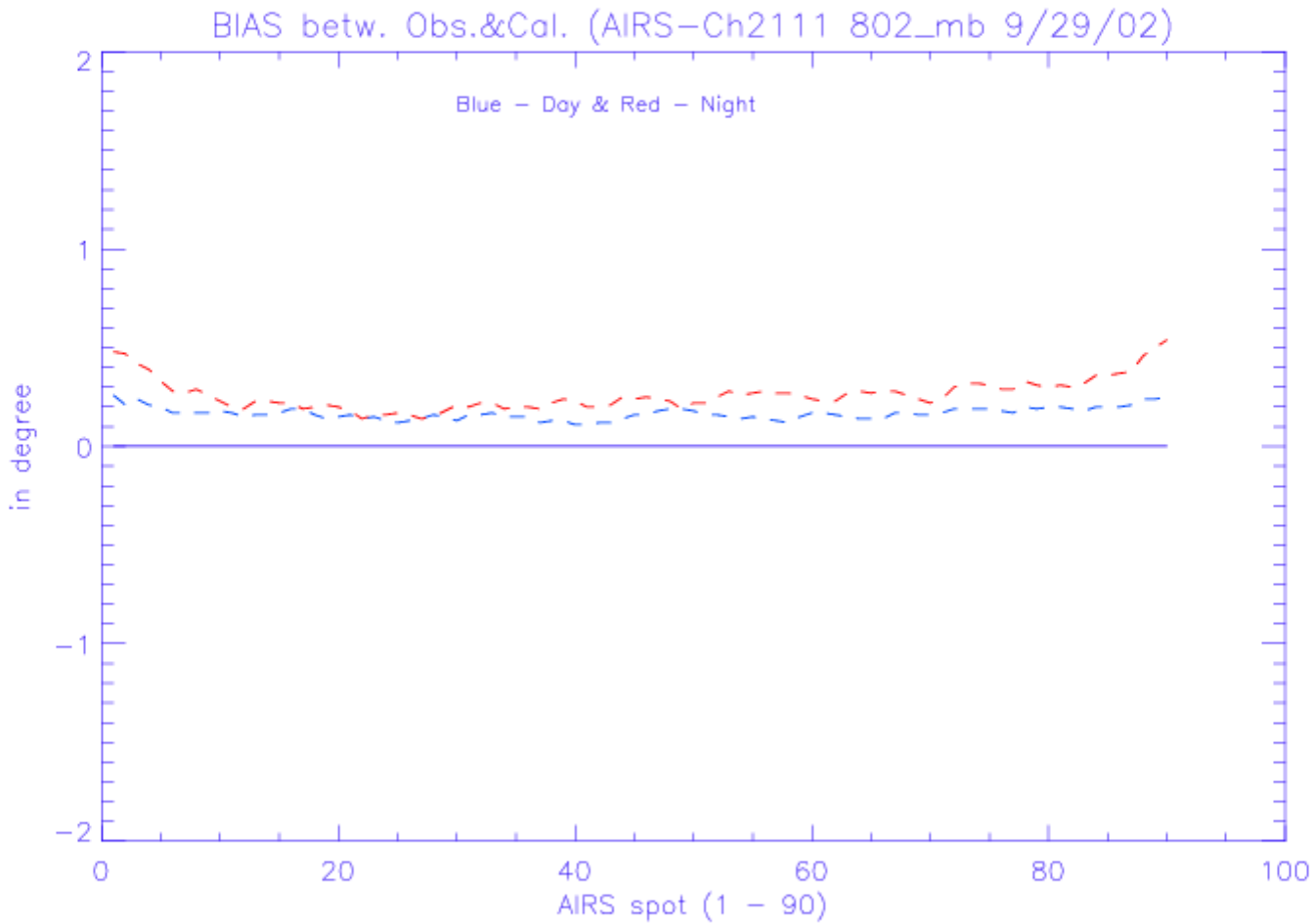

BIAS betw. Obs.&Cal. (AIRS-Ch1918 753_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

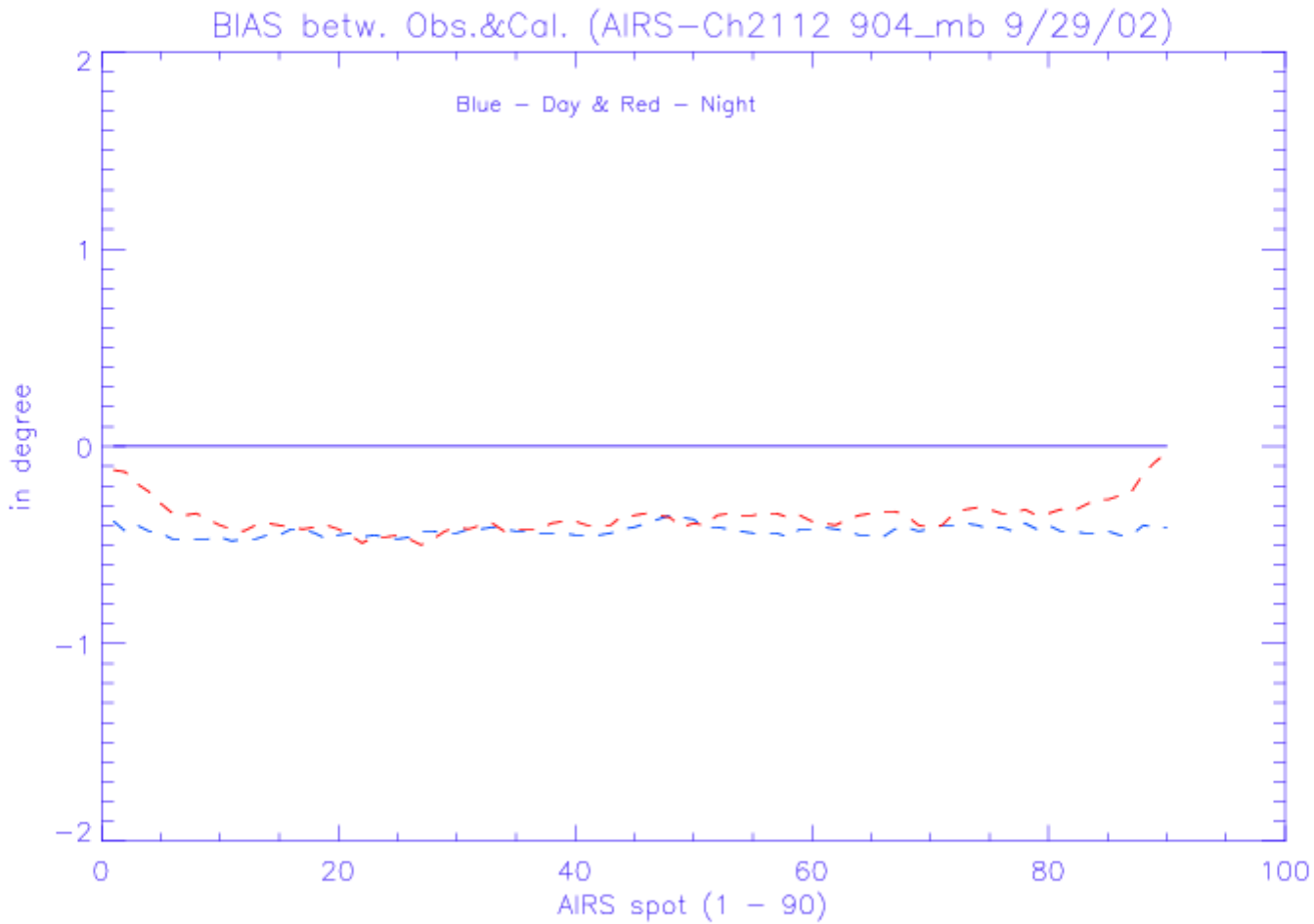

BIAS betw. Obs.&Cal. (AIRS-Ch1926 555_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)


BIAS betw. Obs.&Cal. (AIRS-Ch1934 515_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)


BIAS betw. Obs.&Cal. (AIRS-Ch0409 802_mb 9/29/02)
Blue - Day & Red - Night
in degree
4
2
0
-2
-4
0
20
40
60
80
100
AIRS spot (1 - 90)


BIAS betw. Obs.&Cal. (AIRS-Ch2110 706_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)


BIAS betw. Obs.&Cal. (AIRS-Ch2111 802_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

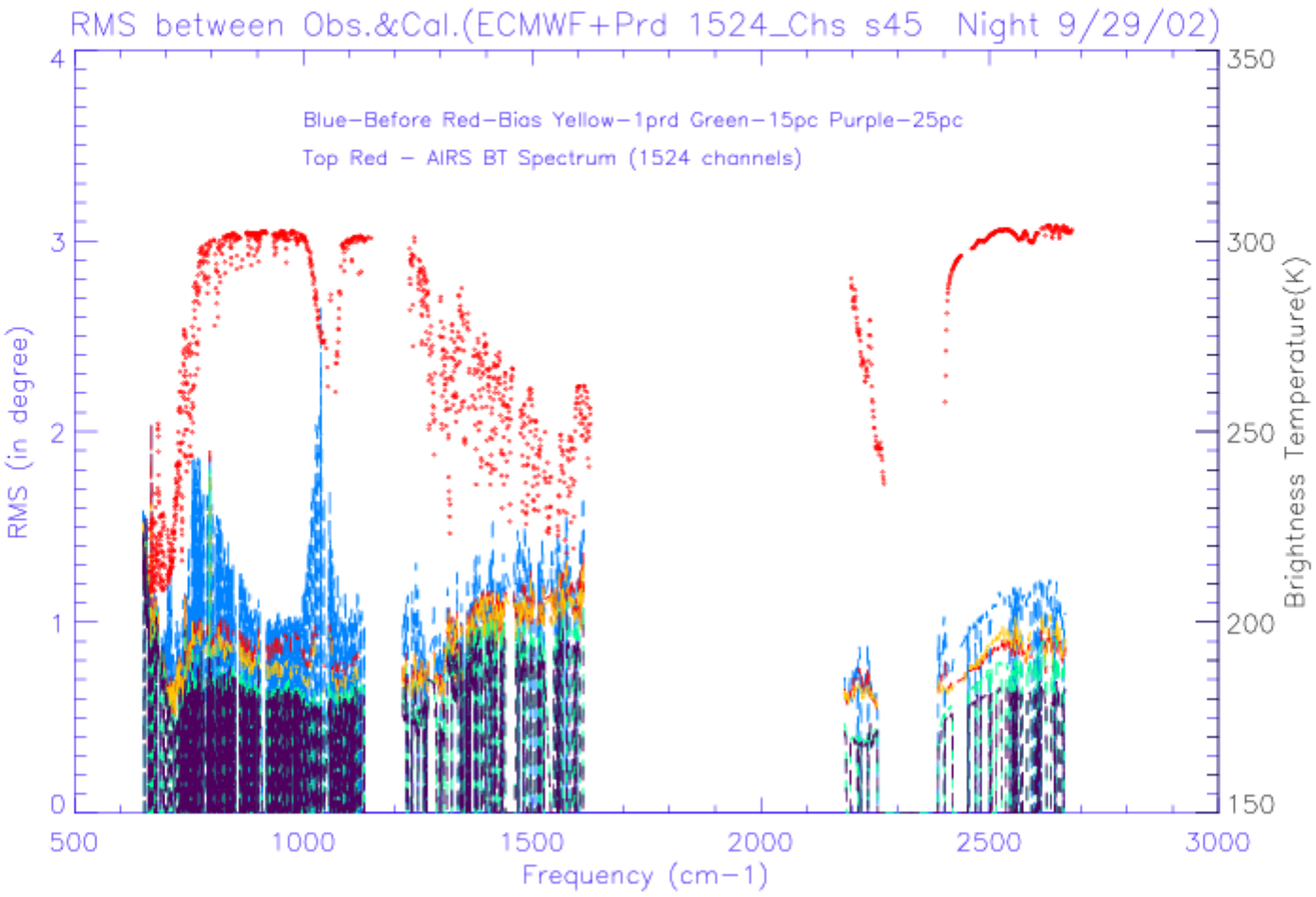

BIAS betw. Obs.&Cal. (AIRS-Ch2112 904_mb 9/29/02)
Blue - Day & Red - Night
in degree
2
1
0
-1
-2
0
20
40
60
80
100
AIRS spot (1 - 90)

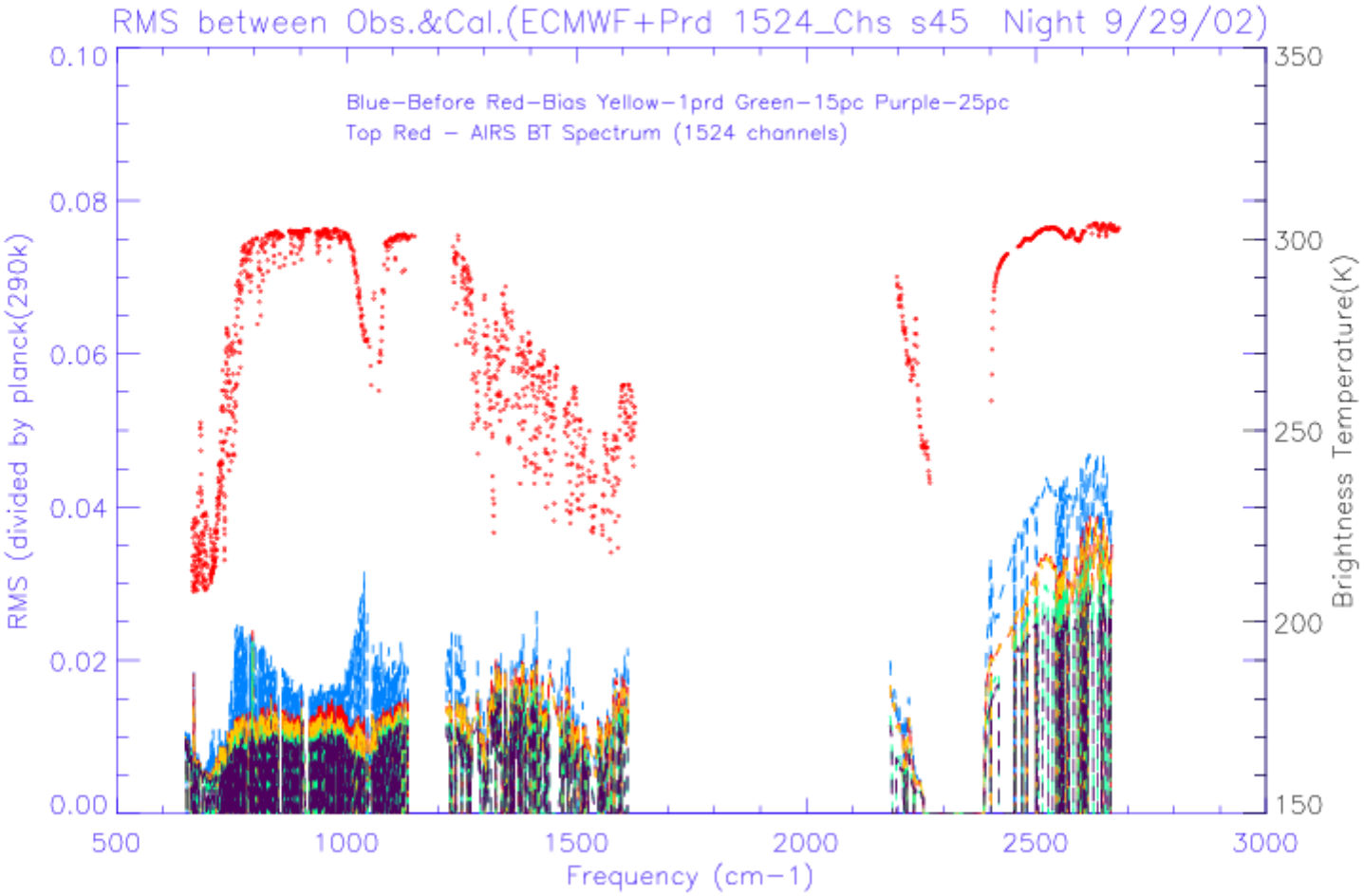
Conclusions

- Biases are small
- Some channels show a slight left to right bias
- Some channels show scan effects
- Upper channels tend to be warm relative to ECMWF
- Lower channels tend to be cold relative to ECMWF
- Short wavelength channels show solar heating

Next slides

- The next two slides show the effect of bias corrections for night and day
- The upper red curve is a typical spectrum for reference
- The blue shows the improvement due to just a bias correction
- The red shows the additional effect of a bias correction plus the channel being predicted
- The yellow shows additional improvement due to 15 using principle component scores
- The cyan shows the improvement in temperature due to 25 principle component scores
- Note the second slide is radiance divided by the radiance at 290K


RMS between Obs.&Cal.(ECMWF+Prd 1524_Chs s45 Night 9/29/02)
Blue-Before Red-Bias Yellow-1prd Green-15pc Purple-25pc
Top Red - AIRS BT Spectrum (1524 channels)
RMS (in degree)
Brightness Temperature(K)
Frequency (cm-1)
0
1
2
3
4
150
200
250
300
350
500
1000
1500
2000
2500
3000


RMS between Obs.&Cal.(ECMWF+Prd 1524_Chs s45 Night 9/29/02)
Blue-Before Red-Bias Yellow-1prd Green-15pc Purple-25pc
Top Red - AIRS BT Spectrum (1524 channels)
RMS (divided by planck(290k)
Brightness Temperature(K)
Frequency (cm-1)
0.10
0.08
0.06
0.04
0.02
0.00
350
300
250
200
150
500
1000
1500
2000
2500
3000

Conclusions

- A large improvement is observed with just a bias adjustment
- A single channel predictor makes a significant additional improvement

colors

- Color guide - the figures do not have legends
- dark blue (1 or 6)
- Green (2 or 7)
- Red (3 or 8)
- cyan (not red) (4 or 9)
- violet (not green) (5 or 10)
- yellow (not blue) (6 or 11)
- gold (7 or 12)
- medium blue (8 or 13)
- dark purple (9 or 14)
- yellow green (10 or 15)